

Health, Safety, and Environmental Impacts During Controlled Long-Term Storage of Spent Nuclear Fuel And High-Level Radioactive Waste in the United States

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Introduction

The long-term controlled storage of spent nuclear fuel (SNF) and high-level radioactive waste (HLW) in the United States would utilize concrete storage modules (CSMs) in above- and belowground settings per the concept of operations described in the Continued Storage Analysis Report (CSAR; DOE 1998a). According to the CSAR, it is assumed that SNF and HLW would remain under active institutional storage control at 72 commercial nuclear generating sites and from 7 to 13 Department of Energy (DOE) facilities for at least 10,000 years. The DOE storage facilities would be located at five sites (the Hanford Site, the Idaho National Engineering and Environmental Laboratory, the Savannah River Site, the Fort St. Vrain site, and the West Valley Demonstration Project). In addition, it is assumed that the design of DOE above-ground SNF storage facilities would be similar to the independent spent fuel storage installations (ISFSIs) licensed by the Nuclear Regulatory Commission for use at commercial nuclear power generating sites.

SNF and HLW would be treated and packaged in dry storage canisters (DSCs), as necessary, to meet repository waste acceptance criteria and stored in CSMs in a condition ready for shipment to a repository. Active institutional storage control would provide regular maintenance and continuous surveillance of CSMs to safeguard the health and safety of CSM workers and surrounding communities in the affected environment. There are two amounts (inventories) of spent nuclear fuel and high-level radioactive waste considered in this analysis—Base and Module 1. The Base inventory of 70,000 metric tons consists of 63,000 metric tons heavy metal (MTHM) of commercial spent nuclear fuel, 2,333 MTHM of DOE spent nuclear fuel, 8,315 canisters of solidified high-level radioactive waste, and 50 metric tons of surplus plutonium. The Module 1 inventory contains more than 107,000 MTHM of commercial and DOE spent nuclear fuel, more than 22,000 canisters of high-level radioactive waste, and 50 metric tons of surplus plutonium that could require controlled storage if a disposal site is not available.

The purpose of this analysis is to estimate the extent of health, safety, and environmental impacts possible with such a long-term SNF and HLW storage program, as indicated by the incidence of the following events: (1) industrial safety illnesses, injuries, and fatalities, (2) radiation-induced latent cancer fatalities (LCFs), (3) commuter accident fatalities, (4) trucking accident fatalities, (5) trucking emissions-induced LCFs, and (6) disposed waste (demolition rubble) volume. To permit comparison of short- and long-term impacts, this analysis is conducted separately for the initial 100-year and full 10,000-year storage periods.

Technical Approach

Storage Packages and Facilities at Commercial Nuclear Generating Sites and DOE Facilities

A number of designs for storage packages and facilities at the commercial nuclear generating sites and DOE facilities would provide adequate protection to the environment from spent nuclear fuel and high-level radioactive waste. Because specific storage designs for most locations have not been selected, a representative range of commercial and DOE designs were chosen for analysis, as described in the following paragraphs. In addition, for purposes of analysis, it is assumed that the commercial and DOE generating sites have sufficient land area to construct the initial and replacement storage facilities and that the initial construction of all dry storage facilities would be completed at the start of this analysis.

Spent Nuclear Fuel Storage Facilities - Most commercial nuclear utilities currently store their spent nuclear fuel in water-filled basins (fuel pools) at the reactor sites. Because they have inadequate storage space, some utilities have built ISFSIs, in which they store dry spent nuclear fuel above ground in metal casks or in welded canisters inside

reinforced concrete storage modules. Other commercial nuclear utilities plan to build ISFSIs so they can proceed with the decommissioning of their nuclear plants and termination of their operating licenses (for example, Rancho Seco and Trojan). Because utilities could elect to continue operations until their fuel pools became full and then cease operations, this analysis initially considered ongoing wet storage in existing fuel pools to be a potentially viable option for spent nuclear fuel storage. However, dry storage is almost certainly the preferred option for long-term spent nuclear fuel storage at commercial nuclear sites because, chief among several reasons, dry storage units are simpler and easier to maintain and they generate minimal, if any, low-level radioactive waste.

Accordingly, this analysis assumes that all commercial spent nuclear fuel would be stored in dry configurations in ISFSIs at existing locations. This assumption includes spent nuclear fuel at sites that no longer have operating nuclear reactors. Although most utilities and DOE have not constructed independent spent fuel storage installations or designed spent nuclear fuel DSCs, this analysis evaluates the impacts of storing all commercial and most DOE spent nuclear fuel in horizontal CSMs on a concrete pad at the ground surface. Concrete storage modules have openings that allow outside air to circulate and remove the heat of radioactive decay. The analysis assumed that spent nuclear fuel from both pressurized-water and boiling-water reactors would be in a dry storage canister inside the concrete storage module. The combination of the DSC and the CSM would provide safe storage of spent nuclear fuel as long as they were maintained properly.

This analysis assumes that DOE would store dry spent nuclear fuel at the Savannah River Site, the Idaho National Engineering and Environmental Laboratory site, and the Fort St. Vrain site in stainless-steel canisters inside above-grade CSMs.

The analysis assumes that DOE would store dry spent nuclear fuel at the Hanford site in below-grade storage facilities. DOE would store Hanford's N-Reactor fuel in the Canister Storage Building, which would consist of three below-grade concrete vaults with air plenums for natural convective cooling. The vaults would contain vertical storage tubes made of carbon steel. Each storage tube, which would hold two spent nuclear fuel stainless steel canisters, would be sealed with a shield plug. DOE would cover the vaults with a structural steel shelter.

High-Level Radioactive Waste Storage Facilities - With one exception, this analysis assumes that DOE would store vitrified HLW in stainless steel canisters in below-grade storage facilities. At the West Valley Demonstration Project site, DOE would use a NRC-licensed dry storage system similar to a commercial ISFSI for HLW storage.

A HLW storage facility consists of four areas: below-grade storage vaults, an operating area above the vaults, air inlet shafts, and air exhaust shafts. The canister cavities are galvanized-steel large-diameter pipe sections arranged in a grid. A concrete base mat supports canister casings. Space between the pipes is filled with overlapping horizontally stepped steel plates that direct most of the ventilation air through the storage cavities. The storage facility's ventilation system would remove the heat of radioactive decay from around the canisters. The exhaust air could pass through high-efficiency particulate air filters before it discharged to the atmosphere through a stack. As an alternative, natural cooling convection without filters could be used. The oversized diameter of the pipe storage cavities would allow air to pass around each cavity.

The below-grade storage vault would be below the operating floor, which would rise slightly above grade. The storage vault would be designed to withstand earthquakes and tornadoes. In addition, the operating area would be enclosed by a metal building, which would provide weather protection and prevent the infiltration of precipitation. The storage vault would be designed to store the canisters and protect the operating personnel, the public, and the environment for as long as the facilities were maintained. The surrounding earth, concrete walls, and a concrete deck that would form the floor of the operating area would provide radiation shielding. Canister cavities would have individual precast concrete plugs.

Storage Concept of Operations

As stated earlier, SNF and HLW would be stored at 72 commercial utility sites and five DOE sites for 10,000 years. Table 1 lists the geographical distribution of the Base and Module 1 inventories of SNF/HLW used in this analysis. Institutional control, which would be maintained for the entire 10,000-year period, would ensure regular maintenance and continuous monitoring at these facilities that would safeguard the health and safety of facility employees, surrounding communities, and the environment. The spent nuclear fuel and immobilized high-level

DOE and commercial utility workers would perform all maintenance including routine industrial maintenance and maintenance unique to a nuclear materials storage facility under standard operating procedures and best management practices to ensure minimal releases of contaminants (industrial and nuclear) to the environment and minimal exposures to workers and the public. This analysis assumes that DOE would administer their facilities in accord with DOE rules (10 CFR Part 835) and Orders and commercial facilities would meet their applicable NRC environmental, safety, and health requirements. It also assumes that storage facilities would require periodic repair and replacement.

CSNF 'Base' Inventory			CSNF	CSNF 'Module 1' Inventory		
Region	Sites	CSMs		Region	Sites	CSMs
1	18	1,732		1	18	2,765
2	18	1,850		2	18	3,109
3	19	1,485		3	19	2,320
4	10	704		4	10	1,388
5	7	521		5	7	923
Subtotal	72	6,292		Subtotal	72	10,505

DSNF 'Base' Inventory			DSNF	DSNF 'Module 1' Inventory				
Region	Location	Sites		CSMs	Region	Location	Sites	CSMs
2	SRS	1	168		2	SRS	1	202
5	Hanford	0	0 ^a		5	Hanford	0	0 ^d
5	INEEL	1	119		5	INEEL	1	174
5	Navy	0	0		5	Navy	1	300
5	FSVrain	1	48		5	FSVrain	1	48
Subtotal	3	331		Subtotal	4	724		

HLW 'Base' Inventory			HLW	HLW 'Module 1' Inventory				
Region	Location	Sites		CSMs ^b	Region	Location	Sites	CSMs ^b
1	WVDP	1	75		1	WVDP	1	75
2	SRS	2	6,022		2	SRS	2	6,188 ^e
5	Hanford	1	1,993 ^c		5	Hanford	5	14,500 ^f
5	INEEL	0	0		5	INEEL	1	1,292
Subtotal	4	8,090			Subtotal	9	22,055	
Total	79	14,713		Total	85	33,284		

f. Co-stored with 809 Hanford SNF canisters.

As developed for analysis, long-term storage control would require workers to perform tasks in two functional areas: construction and operation (DOE 1998a). Under the construction functional area, workers would build, demolish, and repair CSMs; operationally, workers would unload and reload CSMs, and monitor CSM industrial security, integrity, and function under a routine surveillance program. Appropriately, the worker level-of-effort, expressed in full-time equivalent (FTE) worker-years^a, differentiating these tasks is the fundamental feature of this analysis. The labor allocated to CSNF/DSNF CSM repair tasks was reasonably assumed to be half those for construction because no data was available in the documents reviewed. Table 2 lists the FTE loads used in this analysis.

Table 2. Full-time equivalent (FTE) worker task loads (worker-years)

Task	Inventory Category		
	CSNF	DSNF	HLW
Construction, FTE/DSC	0.75 ^a	0.75 ^a	0.53 ^f
Demolition, FTE/DSC	0.091 ^b	0.091 ^b	0.065 ^f
Unload/Reload, FTE/DSC	0.0083 ^c	0.0083 ^c	0.065 ^f
Repair, FTE/DSC	0.38 ^d	0.38 ^d	0.111 ^g
Surveillance, FTE/site-year	8.77 ^e	8.77 ^e	8.77 ^e

- Adapted from the Calvert Cliffs ISFSI environmental assessment (NRC 1991, p. 23).
- Construction task load normalized by applying the HLW demolition/construction task load ratio as a factor.
- Adapted from the Calvert Cliffs ISFSI Updated Safety Analysis Report (BGE19R4, Table 7.4-1).
- Repair task load is assumed to be half the construction task load.
- Surveillance task load is assumed to be two workers (security and radiation protection) providing constant facility coverage.
- Poe 1999b
- Adapted from Poe 1999b as the average FTE load representing the humid (Region 2) and arid (Region 5) environments for the "Total Roof Maintenance" activity.

A contributing parameter to the FTE load analysis is the task recurrence frequency, which is used to specify the worker level-of-effort for the entire storage period of interest (i.e., 100 or 10,000 years). These two periods of interest were chosen to facilitate comparisons with other SNF/HLW management strategies being contemplated by DOE. The task recurrence frequency specifies the number of times a given DSC storage task is performed during the period of interest. The worker task recurrence frequencies assumed for this analysis are shown in Table 3.

Table 3. Assumed worker task recurrence frequencies (task⁻¹)

Task	Inventory Category ^a		
	CSNF	DSNF	HLW
Construction	0 • 100	0 • 100	0 • 3
Demolition	0 • 99	0 • 99	0 • 2 ^b
Unload/Reload	0 • 100	0 • 100	0 • 3
Repair ^c	1 • 1	1 • 1	1 • 50 ^d
Surveillance (annual)	100 • 10,000	100 • 10,000	100 • 10,000

- The first and second values apply to an initial 100-year and 10,000-year storage analysis period, respectively.
- Adapted from the Poe 1999b based on the assumption that construction would be the final structural task; this approach is consistent with the analysis of CSNF and DSNF inventory categories.
- The single repair occurs during the first one hundred-year period.
- Adapted from Poe 1999b as the higher of the two "Total Roof Maintenance" activity recurrence frequencies specified for the humid (Region 2) and arid (Region 5) environments.

Industrial Safety Impacts

^a One FTE worker-year is equivalent to 2,000 hours worked.

The industrial hazards evaluated were (1) total recordable injury and illness cases, (2) lost workday cases associated with workplace injuries and illnesses, and (3) workplace fatalities. The estimates of these traumas were based primarily on the staffing level of involved workers assigned to spent nuclear fuel and high-level radioactive waste management tasks, coupled with representative workplace loss indicators maintained by the Bureau of Labor Statistics or the DOE Computerized Accident/Incident Reporting System (CAIRS) database. Involved worker risk exposure estimates were based on crew sizes to determine the number of full-time equivalent work years assigned to construction and to operations, surveillance, and maintenance tasks. DOE used representative historic total recordable case, lost workday case, and fatality incident data to project the associated trauma incidence based on the number of workers and their job functions.

The incidence of worker industrial safety impacts (injuries, illnesses, and fatalities) expected under the CSM storage program was estimated using representative loss rates compiled by the U.S. Department of Labor (DOL) and DOE for similar construction and operations activities. Activity loss rates (per FTE worker-year) were selected for three impact categories, as follows:

- *Total Recordable Cases (TRC)* include any occupational injuries or illnesses that result in (1) fatalities, regardless of the time between the injury and death or the length of the illness, (2) lost work day cases, other than fatalities, that result in lost work days, (3) nonfatal cases without lost workdays that result in transfer to another job, termination of employment, or require medical treatment (other than first aid), or involved loss of consciousness or restriction of work or motion, or (4) any diagnosed occupational illnesses that are reported to the employer but are not classified as fatalities or lost workday cases. The TRC incidence rates for construction (0.082) and operations (0.030) were obtained from the DOL Bureau of Labor Statistics (BLS) for the 'General Building Contractors' sector (DOL 1996) and the DOE Computerized Accident and Incident Reporting System (CAIRS) database for 'Waste Operations,' (DOE 1997a) respectively. The TRC incidence rates were based on the national average industrial sector experience for the year 1996 and DOE average operational experience for the 1992 – 1997 period of record. These construction and operations TRC rates are shown in Table 4 as 'TRC_c' and 'TRC_o' respectively.
- *Lost Workday Cases (LWC)* include the total number of restricted work activity and lost workdays (more than half a workday) due to lost workday or restricted activity injuries and illnesses. The LWD case rates used in the analysis for construction (0.036) and operations (0.013) were obtained from the BLS for the 'General Building Contractors' sector (DOL 1996), as well as the DOE CAIRS database for 'Waste Operations,' (DOE 1997a) respectively. These LWC incidence rates were based on the national average industrial sector experience for the year 1996 and DOE average operational experience for the 1992 – 1997 period of record. These construction and operations LWC rates are shown in Table 4 as 'LWC_c' and 'LWC_o' respectively.
- *Fatalities* using rates for construction (0.00012) and operations (0.000029) obtained from the Occupational Safety and Health Administration (OSHA) for 'Construction Trades' and the DOE CAIRS database for 'DOE and Contractor Fatality Rates,' respectively. These fatality incidence rates were based on the national average industrial sector experience for the 1994 – 1995 period of record (DOL 1995) and average DOE and contractor fatality rates from 1988 through the third quarter of 1997 (DOE 1997b). These construction and operations fatality rates are shown in Table 4 as 'ISF_c' and 'ISF_o' respectively.

The product of the FTE worker-years and each loss rate yields the expected worker impacts. Where desirable to convert FTE worker-years to numbers of workers, an occupational lifetime of 50 years can be conservatively assumed, i.e., there are [50 FTE worker-years × 2,000 hours per FTE worker-year] 100,000 hours available in an occupational lifetime. The 50-year lifetime was adapted from the consensus approach developed for radiation risk assessments conducted by Federal agencies (CIRRPC 1992).

Collective Radiation Doses and Latent Cancer Fatalities

During the construction of the first CSM at a site, workers would be exposed to small levels of radiation because new concrete storage modules would be built adjacent to those already filled with radioactive materials. Workers constructing new CSMs would be exposed to radiation emanating from filled modules. However, engineered features of the concrete storage modules and application of administrative controls would ensure that exposures would be within applicable Federal limits (10 CFR Part 20 and 10 CFR Part 835) and as low as reasonably

achievable. Very low exposures to future construction workers would occur as they built replacement facilities adjacent to the existing facilities. Transferring the dry storage canisters from old to new concrete storage modules would result in some additional exposures to workers.

During normal operations, facility workers would be exposed to low levels of external radiation while performing routine surveillance and monitoring activities, changing high-efficiency particulate air filters on ventilation systems (for high-level radioactive waste storage facilities), repackaging material from dry storage containers not meeting licensing requirements, transferring dry storage canisters between concrete storage modules, and maintaining and repairing the facilities. In addition, individuals employed at the nearby nuclear generating plant but not directly involved with activities at the spent nuclear fuel storage facility (noninvolved workers) would be exposed to low levels of external radiation emanating from the filled concrete storage modules. Activities within the facility boundaries would be in accordance with DOE or Nuclear Regulatory Commission guidelines for nuclear facility worker protection.

This analysis treated the dose rates from DOE spent nuclear fuel as equivalent to commercial spent nuclear fuel on a volume basis. This simplifying, but conservative, assumption had minimal effect on estimated individual and population doses because of the relatively small quantities of DOE spent nuclear fuel (less than 10 percent of the total) and essentially equal volumetric radioactivity in comparison to commercial spent nuclear fuel basis (DOE 1998b). The analysis separated the calculation of dose rates from high-level radioactive waste because of the difference in source materials.

For each inventory, this analysis first estimated the collective radiation doses (CDs) accrued by the SNF/HLW storage workforce using the product of each task recurrence FTE and the associated task CD factor. The task CD factors (Poe 1999b; Rollins 1998) are named in Table 4 as 'SNF[HLW]CNSTCD,' 'SNF[HLW]DMLSCD,' 'SNF[HLW]LDRLDCD,' 'SNF[HLW]REPRCD,' and 'SNF[HLW]SURVCD.' Next, the calculated task CDs were adjusted for radioactive decay of the source material using dose reduction factors (DRFs; Rollins 1998, Fulmer 1999) developed specifically for SNF and HLW inventories. To increase calculation efficiency, these DRFs were adapted for use in this analysis by selecting the most probable values for the following time periods (years): 0 – 100, 100, 200, 300, 400, 500, and 600 – 10,000. These values are listed in Table 4 for SNF (S) and HLW (H) as S[H]DRF_{surv}, S[H]DRF₁, S[H]DRF₂, S[H]DRF₃, S[H]DRF₄, S[H]DRF₅, and S[H]DRF₆, respectively. Finally, the LCF incidence is estimated by applying the nominal latent cancer fatality risk factor for workers (Table 4: 'LCF_w'), 0.0004 per rem (CIRRPC 1992), to the total CD results.

Since it is possible that members of the public may reside in regions influenced by the SNF and HLW storage sites, the public CD accrued is considered in this analysis. It was determined that there could be no offsite radiological impacts attributed to any of the DSNF or HLW storage sites (Poe 1999b). Conversely, offsite radiological impacts are possible at CSNF storage sites (Rollins 1998) as listed for the Table 4 parameter 'PUBDOSE'. The public CD is estimated using the product of the CSNF inventories with the 'PUBDOSE' dose factor.

Commuter Fatalities

This analysis projects the number of round trips workers would take to the CSM sites assuming no ride sharing and that a trip would be initiated for every 8 hours of allocated labor (Table 4: 'TRIPHR'). The amount of travel was determined from estimates of personnel needed to construct the storage facilities, load and reload the canisters into the storage modules, and conduct routine surveillance and repairs. This travel information is used to estimate the incidence of traffic-related accidents that could be attributed to worker commutes. A fatality rate of 37 per 100,000,000 round trips (Table 4: 'CMTRF') is used to project commuter fatalities based on a commuting employee fatality rate of 1 per 100 million vehicle-kilometers traveled (BTS 1998) and an average round-trip commute distance of 37 km (ORNL 1999).

Trucking Accident Fatalities

The number of trucks hauling CSM construction/repair^b materials to, and CSM demolition/repair rubble from, the storage sites is projected to estimate the number of truck accidents resulting in a fatality. The number of truckloads of rubble hauled away for each SNF and HLW CSM demolished/repairs is shown in Table 4 as 'SNFRBL', 'HLWRBL', and 'HLWRPR'. Since the number of truckloads of SNF and HLW CSM construction/repair materials hauled-in was calculated to be 61.5%^c of the respective outbound rubble value, the parameters 'SNFRBL', 'HLWRBL', and 'HLWRPR' have been escalated by the factor 1.615 to account for the transport of both (outbound) rubble and (inbound) construction/repair materials. After the total number of truckloads of rubble and construction/repair materials is calculated using the Table 1 inventory information, the fatal accident incidence is calculated by multiplying the number of truckloads with the Table 4 fatal accident rate estimator 'TRKRF'. The trucking fatal accident rate estimator is based on the average effects of rural, suburban, and urban travel (Saricks and Tompkins 1999).

Trucking Emissions-Induced Latent Cancer Fatalities

The LCF incidence attributed to inhalation of hazardous air pollutants (HAPs) emitted by trucks hauling CSM construction/repair materials to, and CSM demolition rubble from, the storage sites is projected in a near-identical manner to that for trucking accident fatalities. The only difference in this calculation is that the number of truckloads is multiplied by the Table 4 emissions LCF estimator 'TRKRLCF'. The HAP emissions LCF estimator is based on the average effects for rural and suburban travel (DOE 1995).

Disposed Waste (Demolition Rubble) Volume

Construction of new facilities and the periodic demolition/repair of old facilities would generate construction debris and sanitary and industrial solid waste. In addition, routine repairs and maintenance to the facilities and storage containers, routine radiological surveys, and overpacking of failed containers would generate sanitary and industrial solid and low-level radioactive wastes. Because a dedicated workforce would not be in residence at the storage facilities, only small amounts of sanitary wastes would be generated except during periods of construction. Since it is expected that the demolition of facilities at the 72 commercial and the demolition/repair of facilities at the five DOE storage locations would generate the greatest amount of waste, only that volume of demolition/repair rubble was estimated in this analysis.

The volume of SNF and HLW CSM demolition/repair rubble generated during each rebuild cycle and requiring offsite disposal is calculated using prepared volume estimators for SNF and HLW DSCs (Poe 1999b; Poe 1999c) and the Table 1 inventories. The rubble volume estimators are listed in Table 4 as 'SNFRBLV', 'HLWRBLV', and 'HLWRPRV'.

^b Repair events are tabulated only for HLW DSCs in vault storage.

^c There would be 6.7 truckloads needed for each CSM constructed [60.2 yd³/CSM @ 9 yd³/truckload] and 10.9 truckloads rubble hauled for each CSM demolished [120.4 yd³/CSM @ 11 yd³/truckload, based on a rubble void fraction of 0.5] (Poe 1999b; Poe 1999c). The truckload quotient (6.7/10.9, or 0.615) defines the fraction used to escalate the initial rubble results in this analysis.

Table 4. Principal storage analysis parameter values and citations

Parameter	Value	Citation
Industrial Safety — Commuter — Trucking — Rubble		
FTE	2,000 worker-hours/full-time equivalent worker-year	Assumption
TRC _c	0.082 total recordable case/construction FTE	DOL 1996
LWC _c	0.036 lost workday case/construction FTE	DOL 1996
ISF _c	0.00012 industrial safety fatality/construction FTE	DOL 1995
TRC _o	0.030 total recordable case/operations FTE	DOE 1997a
LWC _o	0.013 lost workday case/operations FTE	DOE 1997a
ISF _o	0.000029 industrial safety fatality/operations FTE	DOE 1997b
TRIPHR	8 worker-hours/commuter round trip	Assumption
CMTRF	3.70×10^{-7} accident fatality/commuter round trip	DOT 1998d, ORNL 1999
SNFRBL	17.6 truckloads rubble/SNF DSC demolished	Poe 1999c
HLWRBL	4 truckloads rubble/HLW DSC demolished	Poe 1999b
TRIPRBL	80.5 round trip km/truckload	Poe 1999b
TRKRF	1.78×10^{-6} trucking accident fatality/truckload	Saricks and Tompkins 1999
TRKRLCF	5.79×10^{-9} hazardous air pollutant latent cancer fatality/truckload	DOE 1995g
SNFRBLV	92.05 m ³ rubble/SNF DSC demolished	Poe 1999c
HLWRBLV	19.06 m ³ rubble/HLW DSC demolished	Poe 1999b
HLWRPRV	1.69 m ³ rubble/HLW DSC repaired	Poe 1999b
HLWRPR	0.39 truckloads rubble/HLW DSC repaired	Poe 1999b
Radiological		
SNFCNSTCD	0.17 worker person-rem/SNF DSC constructed	Rollins 1998
SNFDMMLSCD	0.17 worker person-rem/SNF DSC demolished	Rollins 1998
SNFLDRLDCD	0.86 worker person-rem/SNF DSC unloaded and reloaded	Rollins 1998
SNFREPRCD	0.039 worker person-rem/SNF DSC repaired	Rollins 1998
SNFSURVCD	0.0004 worker person-rem/year/SNF DSC surveilled	Rollins 1998
SDRF _{surv}	0.500 SNF dose rate reduction factor, t = 0 – 100 years	Rollins 1998
SDRF ₁	0.290 SNF dose rate reduction factor, t = 100 years	Rollins 1998
SDRF ₂	0.181 SNF dose rate reduction factor, t = 200 years	Rollins 1998
SDRF ₃	0.144 SNF dose rate reduction factor, t = 300 years	Rollins 1998
SDRF ₄	0.123 SNF dose rate reduction factor, t = 400 years	Rollins 1998
SDRF ₅	0.107 SNF dose rate reduction factor, t = 500 years	Rollins 1998
SDRF ₁₀₀	0.024 SNF dose rate reduction factor, t = 600 – 10,000 years	Rollins 1998
HLWCNSTCD	0 worker person-rem/HLW DSC constructed	Poe 1999b
HLWDMMLSCD	0 worker person-rem/HLW DSC demolished	Poe 1999b
HLWLDRLDCD	0.465 worker person-rem/HLW DSC unloaded and reloaded	Poe 1999b
HLWREPRCD	0.245 worker person-rem/HLW DSC repaired	Poe 1999b
HLWSURVCD	0.0012 worker person-rem/year/HLW DSC surveilled	Poe 1999b
HDRF _{surv}	0.129 HLW dose rate reduction factor t = 0 – 100 years	Fulmer 1999
HDRF ₁	0.015 HLW dose rate reduction factor, t = 100 years	Fulmer 1999
HDRF ₂	0.004 HLW dose rate reduction factor, t = 200 years	Fulmer 1999
HDRF ₃	0.002 HLW dose rate reduction factor, t = 300 years	Fulmer 1999
HDRF ₄	0.0012 HLW dose rate reduction factor, t = 400 years	Fulmer 1999
HDRF ₅	0.0009 HLW dose rate reduction factor, t = 500 years	Fulmer 1999
HDRF ₁₀₀	0.001 HLW dose rate reduction factor, t = 600 – 10,000 years	Fulmer 1999
PUBDOSE	0.002 public person-rem/year/CSNF DSC maintained	Rollins 1998
LCF _w	0.0004 latent cancer fatality/worker person-rem	CIRRPC 1992
LCF _p	0.0005 latent cancer fatality/public person-rem	CIRRPC 1992

Analysis Results

The analysis is shown in the Attachment A (10,000-year storage period), Attachment B (initial 100-year storage period), and Attachment C (reference HLW case 10,000-year storage period) Microsoft® Excel workbooks. The following discussion describes the structure and content of these workbooks.

Attachment A

The 10,000-year storage calculations are implemented across seven worksheets, as follows:

- 'Inventories' (page 1) identifying the Base and Module 1 quantities of CSNF, DSNF, and HLW included in the analysis (identical to Table 1 of this report).
- 'Input Deck' (page 2) showing the principal analysis parameters and their values (identical to Table 4 of this report).
- 'CSNF' (pages 3 – 8) containing the impact analysis for CSNF storage in five geographical regions. The boxed area on page 3, "CSNF DSC Caretaker FTE Loading," shows how the FTE worker-years of effort are derived (these values are also shown in Table 2 of this report), along with the recurrence frequency (see also Table 3) and recurrence FTE. The ensuing calculations are structured as follows: industrial/commuter safety (Base inventory), radworker CD (Base inventory), and public CD (Base inventory). Beginning on page 6, this structure is repeated for the Module 1 inventory.

The CSNF calculation results are summarized across regions in the boxed areas on page 4 (industrial/commuter safety - Base), page 5 (radworker and public CD - Base), page 7 (industrial and commuter safety – Module 1), and page 8 (radworker and public CD – Module 1). Since the radiological impacts analysis is time-dependent, calculations are performed for the six time periods shown in each table header (i.e., results at the following times (years): 100, 200, 300, 400, 500, and 600 through 10,000).

- 'DSNF' (pages 9 – 12) containing the impact analysis for DSNF storage in two geographical regions (there is no DOE SNF stored in the other three regions). Since it was determined that no offsite radiological effects were possible with DSNF storage, there is no public CD analysis performed. The DSNF worksheet is otherwise structured the same as the CSNF worksheet.
- 'HLW' (pages 13 – 16) containing the impact analysis for HLW storage in three geographical regions (there is no DOE HLW stored in the other two regions). As was the case for DSNF storage, no public CD analysis was performed. The HLW worksheet is structured the same as the DSNF worksheet.
- 'Rubble' (pages 17 – 18) containing the impact analysis for construction materials and demolition debris for CSNF, DSNF, and HLW storage sites. Included in the this worksheet are the following regional impacts: rubble/construction material volume, number of truckloads of material, and the number of traffic and emissions-related fatalities expected as a result of hauling the identified materials. The results for "Truckloads" have been escalated to account for the amount of construction materials brought in to each site to rebuild each CSM. Thus, all the transportation impacts except rubble volume include the effects of construction materials being transported to each site.
- 'Chp. 7 Input' (page 19) contains 10,000-year results summarized for use in preparing the Yucca Mountain EIS; these results are reproduced in Table 5 below.

Table 5. Summary of calculated impacts during the controlled storage of CSNF, DSNF, and HLW for 10,000 years^a

Total of Inventory Class	Base	Module 1	Difference
Fatalities			
Industrial incident fatalities	273	347	74
Radiation exposure LCF ^b (public)	1.8	3.0	1.2
Radiation exposure LCF (workers)	10.5	17.9	7.4
Commuter accident fatalities	690	785	95
Trucking accident fatalities	21	36	15
Trucking HAP ^c emissions LCF	0.07	0.12	0.05
Total Fatalities	996	1,189	192
Other Impacts			
FTE worker-years	7.5×10^6	8.5×10^6	1.0×10^6
Worker population	149,246	169,699	20,453
Worker population (single-site average)	9.4	10.0	0.5
Collective public dose, person-rem	3,557	5,939	2,382
Collective worker dose, person-rem	26,262	44,800	18,538
Total recordable injury/illness cases	255,975	312,045	56,071
Lost workday cases	111,001	135,640	24,639
Commuter round trips	1.9×10^9	2.1×10^9	2.6×10^8
Demolition rubble volume, m ³	6.1×10^7	1.1×10^8	4.4×10^7

a. Insignificant figures are shown for comparative purposes.

b. LCF – Latent cancer fatality

c. HAP – Hazardous air pollutant

Attachment B

The 100-year storage calculations are implemented in a separate workbook across seven worksheets that are structurally identical to Attachment A. The principal analytical difference is that the FTE worker-years for CSNF, DSNF, and HLW storage are adjusted for 100 years of activity only. Information in shaded cells of the Attachment B workbook is to be ignored. The worksheet labeled 'Chp. 7 Input' (page 19 of Attachment B) contains 100-year results summarized for use in preparing the Yucca Mountain EIS; these results are reproduced in Table 6 below. Please note that the Table 6 results also apply to the 100-year reference HLW case.

Table 6. Summary of calculated impacts during the controlled storage of CSNF, DSNF, and HLW for an initial 100 years^a

Total of Inventory Class	Base	Module 1	Difference
Fatalities			
Industrial incident fatalities	2.4	2.9	0.5
Radiation exposure LCF ^b (public)	0.16	0.26	0.11
Radiation exposure LCF (workers)	1.1	1.9	0.8
Commuter accident fatalities	6.6	7.4	0.8
Trucking accident fatalities	0.0	0.0	0.0
Trucking HAP ^c emissions LCF	0.0	0.0	0.0
Total Fatalities	10.3	12.5	2.3
Other Impacts			
FTE worker-years	71,750	80,285	8,535
Worker population	1,435	1,606	171
Worker population (single-site average)	9.1	9.4	0.4
Collective public dose, person-rem	315	526	211
Collective worker dose, person-rem	2,662	4,670	2,008
Total recordable injury/illness cases	2,328	2,754	426
Lost workday cases	1,008	1,194	187
Commuter round trips	1.8×10^7	2.0×10^7	2.1×10^6
Demolition rubble volume, m ³	13,687	37,312	23,626

a. Insignificant figures are shown for comparative purposes.

b. LCF – Latent cancer fatality

c. HAP – Hazardous air pollutant

Attachment C

10,000-year storage calculations for a reference HLW storage case are implemented in a separate workbook across seven worksheets that are structurally identical to Attachment A. The analytical difference in the 10,000-year reference HLW case resides solely in the mostly higher recurrence frequencies for HLW inventory storage tasks which are specified in the 'HLW' worksheet as follows: Construction (100), Demolition (99), Unload/Reload (100), Repair (0), and Surveillance (10,000). These recurrence frequencies may be compared to the "baseline" frequencies listed in Table 3. Information in shaded cells of the Attachment C workbook is to be ignored. The worksheet labeled 'Chp. 7 Input' (page 19 of Attachment C) contains 10,000-year results summarized for use in preparing the Yucca Mountain EIS; these results are reproduced in Table 7 below.

Table 7. Summary of calculated impacts during the controlled storage of CSNF, DSNF, and HLW for 10,000 years (Reference HLW Case)^a

Total of Inventory Class	Base	Module 1	Difference
Fatalities			
Industrial incident fatalities	325	490	165
Radiation exposure LCF ^b (public)	1.8	3.0	1.2
Radiation exposure LCF (workers)	10.6	18.2	7.6
Commuter accident fatalities	734	905	171
Trucking accident fatalities	26	49	23
Trucking HAP ^c emissions LCF	0.08	0.16	0.08
Total Fatalities	1,097	1,465	368
Other Impacts			
FTE worker-years	7.9×10^6	9.8×10^6	1.8×10^6
Worker population	158,706	195,642	36,936
Worker population (single-site average)	10.0	11.5	1.5
Collective public dose, person-rem	3,557	5,939	2,382
Collective worker dose, person-rem	26,554	45,596	19,042
Total recordable injury/illness cases	292,066	411,021	118,955
Lost workday cases	126,959	179,401	52,442
Commuter round trips	2.0×10^9	2.4×10^9	4.6×10^8
Demolition rubble volume, m ³	7.6×10^7	1.4×10^8	6.8×10^7

a. Insignificant figures are shown for comparative purposes.

b. LCF – Latent cancer fatality

c. HAP – Hazardous air pollutant

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Attachment A

10,000-Year Health, Safety, and Environmental Impacts Calculations

CSNF Inventory - Base		
Region	Sites	DSCs
1	18	1,732
2	18	1,850
3	19	1,485
4	10	704
5	7	521
Subtotal	72	6,292

DSNF Inventory - Base		
Region	Sites	DSCs
2 SRS	1	168
5 Hanford	0	0
5 INEEL	1	119
5 Navy	0	0
5 FSVrain	1	48
Subtotal	3	335

HLW Inventory - Base		
Region	Sites	DSCs
1 WVDP	1	75
2 SRS	2	6,022
5 Hanford	1	1,993
5 INEEL	0	0
Subtotal	4	8,090
Total	79	14,717

CSNF Inventory - Module 1		
Region	Sites	DSCs
1	18	2,765
2	18	3,109
3	19	2,320
4	10	1,388
5	7	923
Subtotal	72	10,505

DSNF Inventory - Module 1		
Region	Sites	DSCs
2 SRS	1	202
5 Hanford	0	0
5 INEEL	1	174
5 Navy	1	300
5 FSVrain	1	48
Subtotal	4	724

HLW Inventory - Module 1		
Region	Sites	DSCs
1 WVDP	1	75
2 SRS	2	6,188
5 Hanford	5	14,500
5 INEEL	1	1,292
Subtotal	9	22,055
Total	85	33,284

<u>Parameter 'Name'</u>	<u>Value</u>
FTE	2,000 worker-hours/FTE
TRC _c	0.082 case/FTE
LWC _c	0.036 case/FTE
ISF _c	0.00012 fatality/FTE
TRC _o	0.030 case/FTE
LWC _o	0.013 case/FTE
ISF _o	0.000029 fatality/FTE
TRIPHR	8 worker-hours/round trip
CMTRF	3.70E-07 commuter fatality/round trip
SNFRBL	17.6 truck loads rubble/SNF DSC demolished
HLWRBL	4 truck loads rubble/HLW DSC demolished
TRIPRBL	80.5 (round trip) km/truck load
TRKRF	1.78E-06 trucking fatality/truck load
TRKRLCF	5.79E-09 emissions fatality/truck load
SNFRBLV	92.05 m ³ rubble/SNF DSC demolished
HLWRBLV	19.06 m ³ rubble/HLW DSC demolished
Radiological Parameters	
LCF _w	0.0004 LCF/person-rem (worker)
LCF _p	0.0005 LCF/person-rem (public)
SNFCNSTCD	0.17 person-rem/SNF DSC constructed
SNFDMLSCD	0.17 person-rem/SNF DSC demolished
SNFLDRLCD	0.86 person-rem/SNF DSC unloaded & reloaded
SNFREPRCD	0.039 person-rem/SNF DSC repaired
SNFSURVCD	0.0004 person-rem/year per SNF DSC surveilled
SDRF ₁	0.290 SNF dose rate (reduction) factor (t = 100y)
SDRF ₂	0.181 SNF dose rate (reduction) factor (t = 200y)
SDRF ₃	0.144 SNF dose rate (reduction) factor (t = 300y)
SDRF ₄	0.123 SNF dose rate (reduction) factor (t = 400y)
SDRF ₅	0.107 SNF dose rate (reduction) factor (t = 500y)
SDRF ₁₀₀	0.024 SNF dose rate (reduction) factor (t = 600 - 10,000y)
SDRF _{surv}	0.50 SNF dose rate (reduction) factor (t = 0 - 100y)
HLWCNSTCD	0 person-rem/HLW DSC constructed
HLWDMLSCD	0 person-rem/HLW DSC demolished
HLWDRLCD	0.465 person-rem/HLW DSC unloaded & reloaded
HLWREPRCD	0.245 person-rem/HLW DSC repaired
HLWSURVCD	0.0012 person-rem/year per HLW DSC surveilled
HDRF ₁	0.015 HLW dose rate (reduction) factor (t = 100y)
HDRF ₂	0.004 HLW dose rate (reduction) factor (t = 200y)
HDRF ₃	0.002 HLW dose rate (reduction) factor (t = 300y)
HDRF ₄	0.0012 HLW dose rate (reduction) factor (t = 400y)
HDRF ₅	0.0009 HLW dose rate (reduction) factor (t = 500y)
HDRF ₁₀₀	0.001 HLW dose rate (reduction) factor (t = 600 - 10,000y)
HDRF _{surv}	0.129 HLW dose rate (reduction) factor (t = 0 - 100y)
PUBDOSE	0.002 (public) person-rem/year/CSNF DSC maintained

Task	CSNF DSC Caretaker FTE Loading				Recurrence Frequency	Recurrence FTE
	Workers	Duration	Wrkr-Hrs	FTE		
Construction	No Data	No Data	1,500	0.75 per DSC	100	75.00
Demolition	No Data	No Data	182	0.091 per DSC	99	9.03
Unload & Reload	No Data	No Data	16.66	0.0083 per DSC	100	0.83
Repair	No Data	No Data	750	0.38 per DSC	1	0.38
Surveillance	2	1	17,532	8.77 per Site	10,000	87,660

CSNF Base Inventory - Region 1 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	129,900	10,631	4,705	16	24.6%	7.5%
Demolition	15,640	1,280	567	2	3.0%	0.9%
Unload & Reload	1,443	43	19	0	0.1%	0.1%
Repair	650	53	24	0	0.1%	0.0%
Surveillance	1,577,880	47,355	20,431	46	72.2%	91.4%
Total	1,725,512	59,363	25,745	63	100.0%	100.0%
Commuter Trips	4.31E+08	Commuter Fatalities		160		

CSNF Base Inventory - Region 2 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	138,750	11,355	5,026	17	25.8%	8.0%
Demolition	16,705	1,367	605	2	3.1%	1.0%
Unload & Reload	1,541	46	20	0	0.1%	0.1%
Repair	694	57	25	0	0.1%	0.0%
Surveillance	1,577,880	47,355	20,431	46	70.9%	90.9%
Total	1,735,570	60,181	26,107	65	100.0%	100.0%
Commuter Trips	4.34E+08	Commuter Fatalities		161		

CSNF Base Inventory - Region 3 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	111,375	9,115	4,034	13	21.1%	6.2%
Demolition	13,410	1,097	486	2	2.5%	0.7%
Unload & Reload	1,237	37	16	0	0.1%	0.1%
Repair	557	46	20	0	0.1%	0.0%
Surveillance	1,665,540	49,986	21,566	48	76.2%	92.9%
Total	1,792,118	60,281	26,122	63	100.0%	100.0%
Commuter Trips	4.48E+08	Commuter Fatalities		166		

CSNF Base Inventory - Region 4 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	52,800	4,321	1,913	6	19.5%	5.6%
Demolition	6,357	520	230	1	2.3%	0.7%
Unload & Reload	586	18	8	0	0.1%	0.1%
Repair	264	22	10	0	0.1%	0.0%
Surveillance	876,600	26,309	11,350	25	78.1%	93.6%
Total	936,608	31,189	13,510	33	100.0%	100.0%
Commuter Trips	2.34E+08	Commuter Fatalities		87		

CSNF Base Inventory - Region 5 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	39,075	3,198	1,415	5	20.3%	5.9%
Demolition	4,705	385	170	1	2.4%	0.7%
Unload & Reload	434	13	6	0	0.1%	0.1%
Repair	195	16	7	0	0.1%	0.0%
Surveillance	613,620	18,416	7,945	18	77.1%	93.3%
Total	658,029	22,028	9,544	23	100.0%	100.0%
Commuter Trips	1.65E+08	Commuter Fatalities		61		

CSNF Base Inventory - Regional Worker Safety Analysis Summary

Region	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
1	1,725,512	59,363	25,745	63	25.7%	25.2%
2	1,735,570	60,181	26,107	65	26.1%	25.3%
3	1,792,118	60,281	26,122	63	25.7%	26.2%
4	936,608	31,189	13,510	33	13.2%	13.7%
5	658,029	22,028	9,544	23	9.3%	9.6%
Total	6,847,837	233,042	101,028	247	100.0%	100.0%
Commuter Trips	1.71E+09	Commuter Fatalities		633		

CSNF Base Inventory - Region 1 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	85	53	42	36	32	928
Demolition	85	53	42	36	32	921
Unload & Reload	432	270	214	183	159	4,695
Repair	20	N/A	N/A	N/A	N/A	20
Surveillance	33	12	10	8	7	223
Total CD	655	388	309	264	229	6,787
Total LCFs	0.3	0.2	0.1	0.1	0.1	2.7

CSNF Base Inventory - Region 2 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	91	57	45	39	34	991
Demolition	91	57	45	39	34	984
Unload & Reload	461	288	229	196	170	5,015
Repair	21	N/A	N/A	N/A	N/A	21
Surveillance	35	13	10	9	8	238
Total CD	700	415	330	282	245	7,250
Total LCFs	0.3	0.2	0.1	0.1	0.1	2.9

CSNF Base Inventory - Region 3 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	73	46	36	31	27	796
Demolition	73	46	36	31	27	790
Unload & Reload	370	231	184	157	137	4,026
Repair	17	N/A	N/A	N/A	N/A	17
Surveillance	28	10	8	7	6	191
Total CD	562	333	265	226	197	5,819
Total LCFs	0.2	0.1	0.1	0.1	0.1	2.3

CSNF Base Inventory - Region 4 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	35	22	17	15	13	377
Demolition	35	22	17	15	13	374
Unload & Reload	176	110	87	74	65	1,909
Repair	8	N/A	N/A	N/A	N/A	8
Surveillance	13	5	4	3	3	91
Total CD	266	158	126	107	93	2,759
Total LCFs	0.1	0.1	0.1	0.0	0.0	1.1

CSNF Base Inventory - Region 5 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	26	16	13	11	9	279
Demolition	26	16	13	11	9	277
Unload & Reload	130	81	65	55	48	1,412
Repair	6	N/A	N/A	N/A	N/A	6
Surveillance	10	4	3	2	2	67
Total CD	197	117	93	79	69	2,042
Total LCFs	0.1	0.0	0.0	0.0	0.0	0.8

CSNF Base Inventory - Regional Radworker CD Analysis Summary

Region	100y	200y	300y	400y	500y	100 - 10Ky
1	655	388	309	264	229	6,787
2	700	415	330	282	245	7,250
3	562	333	265	226	197	5,819
4	266	158	126	107	93	2,759
5	197	117	93	79	69	2,042
Total CD	2,381	1,410	1,122	958	834	24,657
Total LCFs	1.0	0.6	0.4	0.4	0.3	9.9

CSNF Base Inventory - Regional Public CD Analysis

Region	100y	200y	300y	400y	500y	100 - 10Ky
1	87	54	43	37	32	979
2	93	58	46	39	34	1,046
3	74	46	37	32	27	840
4	35	22	18	15	13	398
5	26	16	13	11	10	295
Total CD	315	197	157	134	116	3,557
Total LCFs	0.2	0.1	0.1	0.1	0.1	1.8

CSNF Module 1 Inventory - Region 1 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	207,375	16,972	7,512	25	33.7%	11.4%
Demolition	24,968	2,043	904	3	4.1%	1.4%
Unload & Reload	2,303	69	30	0	0.1%	0.1%
Repair	1,037	85	38	0	0.2%	0.1%
Surveillance	1,577,880	47,355	20,431	46	62.0%	87.0%
Total	1,813,563	66,524	28,914	74	100.0%	100.0%
Commuter Trips	4.53E+08	Commuter Fatalities		168		

CSNF Module 1 Inventory - Region 2 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	233,175	19,083	8,446	28	36.2%	12.7%
Demolition	28,074	2,298	1,017	3	4.4%	1.5%
Unload & Reload	2,590	78	34	0	0.1%	0.1%
Repair	1,166	95	42	0	0.2%	0.1%
Surveillance	1,577,880	47,355	20,431	46	59.2%	85.6%
Total	1,842,885	68,909	29,970	77	100.0%	100.0%
Commuter Trips	4.61E+08	Commuter Fatalities		170		

CSNF Module 1 Inventory - Region 3 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	174,000	14,240	6,303	21	29.1%	9.3%
Demolition	20,950	1,715	759	3	3.5%	1.1%
Unload & Reload	1,933	58	25	0	0.1%	0.1%
Repair	870	71	32	0	0.1%	0.0%
Surveillance	1,665,540	49,986	21,566	48	67.2%	89.4%
Total	1,863,292	66,070	28,684	72	100.0%	100.0%
Commuter Trips	4.66E+08	Commuter Fatalities		172		

CSNF Module 1 Inventory - Region 4 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	104,100	8,520	3,771	12	31.6%	10.5%
Demolition	12,534	1,026	454	2	3.8%	1.3%
Unload & Reload	1,156	35	15	0	0.1%	0.1%
Repair	521	43	19	0	0.2%	0.1%
Surveillance	876,600	26,309	11,350	25	64.3%	88.1%
Total	994,910	35,931	15,609	40	100.0%	100.0%
Commuter Trips	2.49E+08	Commuter Fatalities		92		

CSNF Module 1 Inventory - Region 5 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	69,225	5,665	2,508	8	30.6%	10.0%
Demolition	8,335	682	302	1	3.7%	1.2%
Unload & Reload	769	23	10	0	0.1%	0.1%
Repair	346	28	13	0	0.2%	0.0%
Surveillance	613,620	18,416	7,945	18	65.5%	88.6%
Total	692,295	24,815	10,777	27	100.0%	100.0%
Commuter Trips	1.73E+08	Commuter Fatalities		64		

CSNF Module 1 Inventory - Regional Worker Safety Analysis Summary

Region	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
1	1,813,563	66,524	28,914	74	25.5%	25.2%
2	1,842,885	68,909	29,970	77	26.7%	25.6%
3	1,863,292	66,070	28,684	72	24.8%	25.9%
4	994,910	35,931	15,609	40	13.6%	13.8%
5	692,295	24,815	10,777	27	9.4%	9.6%
Total	7,206,945	262,250	113,955	290	100.0%	100.0%
Commuter Trips	1.80E+09	Commuter Fatalities		667		

CSNF Module 1 Inventory - Region 1 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	136	85	68	58	50	1,482
Demolition	136	85	68	58	50	1,470
Unload & Reload	690	430	342	292	254	7,496
Repair	31	N/A	N/A	N/A	N/A	31
Surveillance	53	19	15	13	11	356
Total CD	1,046	620	493	421	366	10,835
Total LCFs	0.4	0.2	0.2	0.2	0.1	4.3

CSNF Module 1 Inventory - Region 2 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	153	96	76	65	57	1,666
Demolition	153	96	76	65	57	1,653
Unload & Reload	775	484	385	329	286	8,428
Repair	35	N/A	N/A	N/A	N/A	35
Surveillance	59	22	17	15	13	400
Total CD	1,176	697	554	474	412	12,183
Total LCFs	0.5	0.3	0.2	0.2	0.2	4.9

CSNF Module 1 Inventory - Region 3 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	114	71	57	49	42	1,243
Demolition	114	71	57	49	42	1,234
Unload & Reload	579	361	287	245	213	6,289
Repair	26	N/A	N/A	N/A	N/A	26
Surveillance	44	16	13	11	10	299
Total CD	878	520	414	353	307	9,091
Total LCFs	0.4	0.2	0.2	0.1	0.1	3.6

CSNF Module 1 Inventory - Region 4 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	68	43	34	29	25	744
Demolition	68	43	34	29	25	738
Unload & Reload	346	216	172	147	128	3,763
Repair	16	N/A	N/A	N/A	N/A	16
Surveillance	26	10	8	7	6	179
Total CD	525	311	248	211	184	5,439
Total LCFs	0.2	0.1	0.1	0.1	0.1	2.2

CSNF Module 1 Inventory - Region 5 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	46	28	23	19	17	495
Demolition	46	28	23	19	17	491
Unload & Reload	230	144	114	98	85	2,502
Repair	10	N/A	N/A	N/A	N/A	10
Surveillance	18	6	5	4	4	119
Total CD	349	207	165	141	122	3,617
Total LCFs	0.1	0.1	0.1	0.1	0.0	1.4

CSNF Module 1 Inventory - Regional Radworker CD Analysis Summary

Region	100y	200y	300y	400y	500y	100 - 10Ky
1	1,046	620	493	421	366	10,835
2	1,176	697	554	474	412	12,183
3	878	520	414	353	307	9,091
4	525	311	248	211	184	5,439
5	349	207	165	141	122	3,617
Total CD	3,975	2,355	1,873	1,600	1,392	41,166
Total LCFs	1.6	0.9	0.7	0.6	0.6	16.5

CSNF Module 1 Inventory - Regional Public CD Analysis

Region	100y	200y	300y	400y	500y	100 - 10Ky
1	139	86	69	59	51	1,563
2	156	97	77	66	57	1,758
3	116	73	58	49	43	1,312
4	70	43	35	29	26	785
5	46	29	23	20	17	522
Total CD	526	328	261	223	194	5,939
Total LCFs	0.3	0.2	0.1	0.1	0.1	3.0

Task	DSNF DSC Caretaker FTE Loading				Recurrence Frequency	Recurrence FTE
	Workers	Duration	Wrkr-Hrs	FTE		
Construction	No Data	No Data	1,500	0.75 per DSC	100	75.00
Demolition	No Data	No Data	182	0.091 per DSC	99	9.03
Unload & Reload	No Data	No Data	16.66	0.0083 per DSC	100	0.83
Repair	No Data	No Data	750	0.38 per DSC	1	0.38
Surveillance	2	1	17,532	8.77 per Site	10,000	87,660

DSNF Base Inventory - Region 2 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	12,600	1,031	456	2	35.6%	12.4%
Demolition	1,517	124	55	0	4.3%	1.5%
Unload & Reload	140	4	2	0	0.1%	0.1%
Repair	63	5	2	0	0.2%	0.1%
Surveillance	87,660	2,631	1,135	3	59.8%	86.0%
Total	101,980	3,796	1,651	4	100.0%	100.0%
Commuter Trips	2.55E+07	Commuter Fatalities		9		

DSNF Base Inventory - Region 5 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	12,525	1,025	454	2	22.2%	6.6%
Demolition	1,508	123	55	0	2.7%	0.8%
Unload & Reload	139	4	2	0	0.1%	0.1%
Repair	63	5	2	0	0.1%	0.0%
Surveillance	175,320	5,262	2,270	5	75.0%	92.5%
Total	189,555	6,419	2,782	7	100.0%	100.0%
Commuter Trips	4.74E+07	Commuter Fatalities		18		

DSNF Base Inventory - Regional Worker Safety Analysis Summary

Region	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
2	101,980	3,796	1,651	4	38.5%	35.0%
5	189,555	6,419	2,782	7	61.5%	65.0%
Total	291,535	10,215	4,433	11	100.0%	100.0%
Commuter Trips	7.29E+07	Commuter Fatalities		27		

DSNF Module 1 Inventory - Region 2 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	15,150	1,240	549	2	39.9%	14.4%
Demolition	1,824	124	55	0	4.0%	1.7%
Unload & Reload	168	5	2	0	0.1%	0.2%
Repair	76	6	3	0	0.2%	0.1%
Surveillance	87,660	2,631	1,135	3	55.8%	83.6%
Total	104,878	4,006	1,744	5	100.0%	100.0%
Commuter Trips	2.62E+07	Commuter Fatalities		10		

DSNF Module 1 Inventory - Region 5 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	39,150	3,204	1,418	5	36.3%	12.7%
Demolition	4,714	386	171	1	4.4%	1.5%
Unload & Reload	435	13	6	0	0.1%	0.1%
Repair	196	16	7	0	0.2%	0.1%
Surveillance	262,980	7,893	3,405	8	59.0%	85.5%
Total	307,474	11,511	5,007	13	100.0%	100.0%
Commuter Trips	7.69E+07	Commuter Fatalities		28		

DSNF Module 1 Inventory - Regional Worker Safety Analysis Summary

Region	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
2	104,878	4,006	1,744	5	26.1%	25.4%
5	307,474	11,511	5,007	13	73.9%	74.6%
Total	412,352	15,518	6,750	17	100.0%	100.0%
Commuter Trips	1.03E+08	Commuter Fatalities		38		

DSNF Base Inventory - Region 2 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	8	5	4	4	3	90
Demolition	8	5	4	4	3	89
Unload & Reload	42	26	21	18	15	455
Repair	2	N/A	N/A	N/A	N/A	2
Surveillance	3	1	1	1	1	22
Total CD	64	38	30	26	22	658
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.3

DSNF Base Inventory - Region 5 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	8	5	4	3	3	89
Demolition	8	5	4	3	3	89
Unload & Reload	42	26	21	18	15	453
Repair	2	N/A	N/A	N/A	N/A	2
Surveillance	3	1	1	1	1	22
Total CD	63	37	30	25	22	654
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.3

DSNF Base Inventory - Regional Radworker CD Analysis Summary

Region : Time	100y	200y	300y	400y	500y	100 - 10Ky
1	64	38	30	26	22	658
2	63	37	30	25	22	654
Total CD	127	75	60	51	44	1,313
Total LCFs	0.1	0.0	0.0	0.0	0.0	0.5

DSNF Module 1 Inventory - Region 1 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	10	6	5	4	4	108
Demolition	10	6	5	4	4	107
Unload & Reload	50	31	25	21	19	548
Repair	2	N/A	N/A	N/A	N/A	2
Surveillance	4	1	1	1	1	26
Total CD	76	45	36	31	27	792
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.3

DSNF Module 1 Inventory - Region 2 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	26	16	13	11	9	280
Demolition	26	16	13	11	9	278
Unload & Reload	130	81	65	55	48	1,415
Repair	6	N/A	N/A	N/A	N/A	6
Surveillance	10	4	3	2	2	67
Total CD	198	117	93	80	69	2,046
Total LCFs	0.1	0.0	0.0	0.0	0.0	0.8

DSNF Module 1 Inventory - Regional Radworker CD Analysis Summary						
Region : Time	100y	200y	300y	400y	500y	100 - 10Ky
1	76	45	36	31	27	792
2	198	117	93	80	69	2,046
Total CD	274	162	129	110	96	2,837
Total LCFs	0.1	0.1	0.1	0.0	0.0	1.1

Task	HLW DSC Caretaker FTE Loading				Recurrence Frequency	Recurrence FTE
	Workers	Duration	Wrkr-Hrs	FTE		
Construction	No Data	No Data	1,069	0.53 per DSC	3	1.60
Demolition	No Data	No Data	130	0.065 per DSC	2	0.13
Unload & Reload	No Data	No Data	130	0.065 per DSC	3	0.20
Repair	No Data	No Data	222	0.111 per DSC	50	5.55
Surveillance	2	1	17,532	8.77 per Site	10,000	87,660

HLW Base Inventory - Region 1 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	120	10	4	0	0.6%	0.1%
Demolition	10	1	0	0	0.0%	0.0%
Unload & Reload	15	0	0	0	0.0%	0.0%
Repair	416	34	15	0	1.9%	0.5%
Surveillance	87,660	2,631	1,135	3	97.5%	99.4%
Total	88,221	2,676	1,155	3	100.0%	100.0%
Commuter Trips	2.21E+07	Commuter Fatalities		8		

HLW Base Inventory - Region 2 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	9,656	790	350	1	11.2%	4.4%
Demolition	783	64	28	0	0.9%	0.4%
Unload & Reload	1,174	35	15	0	0.3%	0.5%
Repair	33,422	2,735	1,211	4	38.6%	15.2%
Surveillance	175,320	5,262	2,270	5	49.0%	79.6%
Total	220,355	8,887	3,874	10	100.0%	100.0%
Commuter Trips	5.51E+07	Commuter Fatalities		20		

HLW Base Inventory - Region 5 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	3,196	262	116	0	8.9%	3.1%
Demolition	259	21	9	0	0.7%	0.3%
Unload & Reload	389	12	5	0	0.3%	0.4%
Repair	11,061	905	401	1	30.9%	10.8%
Surveillance	87,660	2,631	1,135	3	59.2%	85.5%
Total	102,564	3,831	1,666	4	100.0%	100.0%
Commuter Trips	2.56E+07	Commuter Fatalities		9		

HLW Base Inventory - Regional Worker Safety Analysis Summary

Region	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
1	88,221	2,676	1,155	3	17.8%	27.3%
2	220,355	8,887	3,874	10	70.7%	68.2%
5	102,564	3,831	1,666	4	29.3%	31.8%
Total	322,919	12,717	5,540	15	100.0%	100.0%
Commuter Trips	8.07E+07	Commuter Fatalities		30		

HLW Module 1 Inventory - Region 1 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	120	10	4	0	0.6%	0.1%
Demolition	10	1	0	0	0.0%	0.0%
Unload & Reload	15	0	0	0	0.0%	0.0%
Repair	416	34	15	0	1.9%	0.5%
Surveillance	87,660	2,631	1,135	3	97.5%	99.4%
Total	88,221	2,676	1,155	3	100.0%	100.0%
Commuter Trips	2.21E+07	Commuter Fatalities		8		

HLW Module 1 Inventory - Region 2 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	9,922	812	359	1	11.3%	4.5%
Demolition	804	66	29	0	0.9%	0.4%
Unload & Reload	1,207	36	16	0	0.3%	0.5%
Repair	34,343	2,811	1,244	4	39.1%	15.5%
Surveillance	175,320	5,262	2,270	5	48.3%	79.1%
Total	221,596	8,986	3,918	11	100.0%	100.0%
Commuter Trips	5.54E+07	Commuter Fatalities		20		

HLW Module 1 Inventory - Region 5 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	25,321	2,072	917	3	10.4%	3.9%
Demolition	2,053	168	74	0	0.8%	0.3%
Unload & Reload	3,079	92	40	0	0.3%	0.5%
Repair	87,646	7,173	3,175	11	36.1%	13.6%
Surveillance	525,960	15,785	6,810	15	52.3%	81.7%
Total	644,059	25,291	11,017	29	100.0%	100.0%
Commuter Trips	1.61E+08	Commuter Fatalities		60		

HLW Module 1 Inventory - Regional Worker Safety Analysis Summary

Region	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
1	88,221	2,676	1,155	3	6.6%	10.2%
2	221,596	8,986	3,918	11	26.5%	25.6%
5	644,059	25,291	11,017	29	73.5%	74.4%
Total	865,655	34,277	14,935	40	100.0%	100.0%
Commuter Trips	2.16E+08	Commuter Fatalities		80		

HLW Base Inventory - Region 1 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	0	0	0	0	0	0
Demolition	0	0	0	0	0	0
Unload & Reload	0	0	0	0	0	0
Repair	0	0	0	0	0	1
Surveillance	1	0	0	0	0	2
Total CD	1	0.1	0.0	0	0	3
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.0

HLW Base Inventory - Region 2 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	0	0	0	0	0	0
Demolition	0	0	0	0	0	0
Unload & Reload	0	0	0	0	0	6
Repair	0	6	0	2	0	61
Surveillance	93	3	1	1	1	151
Total CD	93	9	1	3	1	217
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.1

HLW Base Inventory - Region 5 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	0	0	0	0	0	0
Demolition	0	0	0	0	0	0
Unload & Reload	0	0	0	0	0	2
Repair	0	2	0	1	0	20
Surveillance	31	1	0	0	0	50
Total CD	31	3	0	1	0	72
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.0

HLW Base Inventory - Regional Radworker CD Analysis Summary

Region : Time	100y	200y	300y	400y	500y	100 - 10Ky
1	1	0	0	0	0	3
2	93	9	1	3	1	217
5	31	3	0	1	0	72
Total CD	125	12	2	4	1	292
Total LCFs	0.1	0.0	0.0	0.0	0.0	0

HLW Module 1 Inventory - Region 1 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	0	0	0	0	0	0
Demolition	0	0	0	0	0	0
Unload & Reload	0	0	0	0	0	0
Repair	0	0	0	0	0	1
Surveillance	1	0	0	0	0	2
Total CD	1	0	0	0	0	3
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.0

HLW Module 1 Inventory - Region 2 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	0	0	0	0	0	0
Demolition	0	0	0	0	0	0
Unload & Reload	0	0	0	0	0	6
Repair	0	6	0	2	0	62
Surveillance	96	3	1	1	1	155
Total CD	96	9	1	3	1	223
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.1

HLW Module 1 Inventory - Region 5 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	0	0	0	0	0	0
Demolition	0	0	0	0	0	0
Unload & Reload	0	0	0	0	0	17
Repair	0	15	0	5	0	159
Surveillance	245	7	3	2	2	395
Total CD	245	23	3	7	2	570
Total LCFs	0.1	0.0	0.0	0.0	0.0	0.2

HLW Module 1 Inventory - Regional Radworker CD Analysis Summary

Region : Time	100y	200y	300y	400y	500y	100 - 10Ky
1	1	0	0	0	0	3
2	96	9	1	3	1	223
5	245	23	3	7	2	570
Total CD	342	32	5	10	2	797
Total LCFs	0.1	0.0	0.0	0.0	0.0	0

CSNF Base Inventory - Demolition Rubble Analysis

Region	Rubble Volume, m3	Truck Loads	Traffic Fatalities	Emissions Fatalities
1	1.58E+07	3.02E+06	5.4	0.018
2	1.69E+07	3.23E+06	5.8	0.019
3	1.35E+07	2.59E+06	4.6	0.015
4	6.42E+06	1.23E+06	2.2	0.007
5	4.75E+06	9.10E+05	1.6	0.005
Total	5.73E+07	1.10E+07	19.6	0.06
	Haul Distance	8.84E+08 km		

DSNF Base Inventory - Demolition Rubble Analysis

Region	Rubble Volume, m3	Truck Loads	Traffic Fatalities	Emissions Fatalities
2	1.53E+06	2.93E+05	0.5	0.0017
5	1.52E+06	2.92E+05	0.5	0.0017
Total	3.05E+06	5.85E+05	1.0	0.0034
	Haul Distance	4.71E+07 km		

HLW Base Inventory - Demolition Rubble Analysis

Region	Rubble Volume, m3	Truck Loads	Traffic Fatalities	Emissions Fatalities	HLWRPRV
1	9.20E+03	1.76E+03	0.003	0.00001	1.69
2	7.39E+05	1.42E+05	0.3	0.0008	HLWRPload
5	2.45E+05	4.68E+04	0.08	0.0003	0.32
Total	9.93E+05	1.90E+05	0.3	0.0011	
	Haul Distance	1.53E+07 km			

All Base Inventories - Demolition Rubble Analysis Summary

Region	Rubble Volume, m3	Truck Loads	Traffic Fatalities	Emissions Fatalities
1	1.58E+07	3.03E+06	5.4	0.018
2	1.91E+07	3.66E+06	6.5	0.021
3	1.35E+07	2.59E+06	4.6	0.015
4	6.42E+06	1.23E+06	2.2	0.007
5	6.51E+06	1.25E+06	2.2	0.007
Total	6.14E+07	1.18E+07	21.0	0.07
	Haul Distance	9.46E+08 km		

CSNF Module 1 Inventory - Demolition Rubble Analysis

Region	Rubble Volume, m3	Truck Loads	Traffic Fatalities	Emissions Fatalities
1	2.52E+07	4.83E+06	8.6	0.028
2	2.83E+07	5.43E+06	9.7	0.031
3	2.11E+07	4.05E+06	7.2	0.023
4	1.26E+07	2.42E+06	4.3	0.014
5	8.41E+06	1.61E+06	2.9	0.009
Total	9.57E+07	1.83E+07	32.7	0.11
	Haul Distance	1.48E+09 km		

DSNF Module 1 Inventory - Demolition Rubble Analysis

Region	Rubble Volume, m3	Truck Loads	Traffic Fatalities	Emissions Fatalities
2	1.84E+06	3.53E+05	0.6	0.0020
5	4.76E+06	9.11E+05	1.6	0.005
Total	6.60E+06	1.26E+06	2.3	0.007
	Haul Distance	1.02E+08 km		

HLW Module 1 Inventory - Demolition Rubble Analysis

Region	Rubble Volume, m3	Truck Loads	Traffic Fatalities	Emissions Fatalities
1	9.20E+03	1.76E+03	0.003	0.000010
2	7.59E+05	1.45E+05	0.3	0.0008
5	1.94E+06	3.71E+05	0.7	0.002
Total	2.71E+06	5.18E+05	0.9	0.003
	Haul Distance	4.17E+07 km		

All Module 1 Inventories - Demolition Rubble Analysis Summary

Region	Rubble Volume, m3	Truck Loads	Traffic Fatalities	Emissions Fatalities
1	2.52E+07	4.83E+06	8.6	0.028
2	3.09E+07	5.93E+06	10.6	0.034
3	2.11E+07	4.05E+06	7.2	0.023
4	1.26E+07	2.42E+06	4.3	0.014
5	1.51E+07	2.89E+06	5.2	0.017
Total	1.05E+08	2.01E+07	35.9	0.12
	Haul Distance	1.62E+09 km		

Controlled Storage Impacts During 10,000 Years			
Total of Inventory Class	Base	Module 1	Difference
Fatalities			
Industrial incident fatalities	273	347	74
Radiation LCFs, public	1.8	3.0	1.2
Radiation LCFs, workers	10.5	17.9	7.4
Commuter accident fatalities	690	785	95
Trucking accident fatalities	21.0	35.9	14.9
Trucking LCFs (emissions)	0.07	0.12	0.05
Total Fatalities	996	1,189	192
Other Impacts			
FTE worker-years	7.5E+06	8.5E+06	1.0E+06
Worker population (all-site average)	149,246	169,699	20,453
Worker population (single-site average)	9.4	10.0	0.5
Total recordable injury/illness cases	255,975	312,045	56,071
Lost workday cases	111,001	135,640	24,639
Commuter round trips	1.9E+09	2.1E+09	2.6E+08
Demolition rubble volume, m ³	6.1E+07	1.1E+08	4.4E+07
Collective dose, person-rem (public)	3,557	5,939	2,382
Collective dose, person-rem (workers)	26,262	44,800	18,538

Impacts Summary

Attachment B

100-Year Health, Safety, and Environmental Impacts Calculations

CSNF Inventory - Base		
Region	Sites	DSCs
1	18	1,732
2	18	1,850
3	19	1,485
4	10	704
5	7	521
Subtotal	72	6,292

CSNF Inventory - Module 1		
Region	Sites	DSCs
1	18	2,765
2	18	3,109
3	19	2,320
4	10	1,388
5	7	923
Subtotal	72	10,505

DSNF Inventory - Base		
Region	Sites	DSCs
2 SRS	1	168
5 Hanford	0	0
5 INEEL	1	119
5 Navy	0	0
5 FSVrain	1	48
Subtotal	3	335

DSNF Inventory - Module 1		
Region	Sites	DSCs
2 SRS	1	202
5 Hanford	0	0
5 INEEL	1	174
5 Navy	1	300
5 FSVrain	1	48
Subtotal	4	724

HLW Inventory - Base		
Region	Sites	DSCs
1 WVDP	1	75
2 SRS	2	6,022
5 Hanford	1	1,993
5 INEEL	0	0
Subtotal	4	8,090
Total	79	14,717

HLW Inventory - Module 1		
Region	Sites	DSCs
1 WVDP	1	75
2 SRS	2	6,188
5 Hanford	5	14,500
5 INEEL	1	1,292
Subtotal	9	22,055
Total	85	33,284

<u>Parameter 'Name'</u>	<u>Value</u>
FTE	2,000 worker-hours/FTE
TRC _c	0.082 case/FTE
LWC _c	0.036 case/FTE
ISF _c	0.00012 fatality/FTE
TRC _o	0.030 case/FTE
LWC _o	0.013 case/FTE
ISF _o	0.000029 fatality/FTE
TRIPHR	8 worker-hours/round trip
CMTRF	3.70E-07 commuter fatality/round trip
SNFRBL	17.6 truck loads rubble & construction materials/SNF DSC demolished
HLWRBL	4 truck loads rubble & construction materials/HLW DSC demolished
TRIPRBL	80.5 (round trip) km/truck load
TRKRF	1.78E-06 trucking fatality/truck load
TRKRLCF	5.79E-09 emissions fatality/truck load
SNFRBLV	92.05 m ³ rubble/SNF DSC demolished
HLWRBLV	19.06 m ³ rubble/HLW DSC demolished
Radiological Parameters	
LCF _w	0.0004 LCF/person-rem (worker)
LCF _p	0.0005 LCF/person-rem (public)
SNFCNSTCD	0.17 person-rem/SNF DSC constructed
SNFDMMLSCD	0.17 person-rem/SNF DSC demolished
SNFLDRDLDCD	0.86 person-rem/SNF DSC unloaded & reloaded
SNFREPRCD	0.039 person-rem/SNF DSC repaired
SNFSURVCD	0.0004 person-rem/year per SNF DSC surveilled
SDRF ₁	0.290 SNF dose rate (reduction) factor (t = 100y)
SDRF ₂	0.181 SNF dose rate (reduction) factor (t = 200y)
SDRF ₃	0.144 SNF dose rate (reduction) factor (t = 300y)
SDRF ₄	0.123 SNF dose rate (reduction) factor (t = 400y)
SDRF ₅	0.107 SNF dose rate (reduction) factor (t = 500y)
SDRF ₁₀₀	0.024 SNF dose rate (reduction) factor (t = 600 - 10,000y)
SDRF _{surv}	0.50 SNF dose rate (reduction) factor (t = 0 - 100y)
HLWCNSTCD	0 person-rem/HLW DSC constructed
HLWDMMLSCD	0 person-rem/HLW DSC demolished
HLWLDRDLDCD	0.465 person-rem/HLW DSC unloaded & reloaded
HLWREPRCD	0.245 person-rem/HLW DSC repaired
HLWSURVCD	0.0012 person-rem/year per HLW DSC surveilled
HDRF ₁	0.015 HLW dose rate (reduction) factor (t = 100y)
HDRF ₂	0.004 HLW dose rate (reduction) factor (t = 200y)
HDRF ₃	0.002 HLW dose rate (reduction) factor (t = 300y)
HDRF ₄	0.0012 HLW dose rate (reduction) factor (t = 400y)
HDRF ₅	0.0009 HLW dose rate (reduction) factor (t = 500y)
HDRF ₁₀₀	0.001 HLW dose rate (reduction) factor (t = 600 - 10,000y)
HDRF _{surv}	0.129 HLW dose rate (reduction) factor (t = 0 - 100y)
PUBDOSE	0.002 (public) person-rem/year/CSNF DSC maintained

Task	CSNF DSC Caretaker FTE Loading				Recurrence Frequency	Recurrence FTE
	Workers	Duration	Wrkr-Hrs	FTE		
Construction	No Data	No Data	1,500	0.75 per DSC	0	0.00
Demolition	No Data	No Data	182	0.091 per DSC	0	0.00
Unload & Reload	No Data	No Data	16.66	0.0083 per DSC	0	0.00
Repair	No Data	No Data	750	0.38 per DSC	1	0.38
Surveillance	2	1	17,532	8.77 per Site	100	877

CSNF Base Inventory - Region 1 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	0	0	0	0	0.0%	0.0%
Demolition	0	0	0	0	0.0%	0.0%
Unload & Reload	0	0	0	0	0.0%	0.0%
Repair	650	53	24	0	14.6%	4.0%
Surveillance	15,779	474	204	0	85.4%	96.0%
Total	16,428	527	228	1	100.0%	100.0%
Commuter Trips	4.11E+06	Commuter Fatalities		2		

CSNF Base Inventory - Region 2 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	0	0	0	0	0.0%	0.0%
Demolition	0	0	0	0	0.0%	0.0%
Unload & Reload	0	0	0	0	0.0%	0.0%
Repair	694	57	25	0	15.4%	4.2%
Surveillance	15,779	474	204	0	84.6%	95.8%
Total	16,473	530	229	1	100.0%	100.0%
Commuter Trips	4.12E+06	Commuter Fatalities		2		

CSNF Base Inventory - Region 3 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	0	0	0	0	0.0%	0.0%
Demolition	0	0	0	0	0.0%	0.0%
Unload & Reload	0	0	0	0	0.0%	0.0%
Repair	557	46	20	0	12.2%	3.2%
Surveillance	16,655	500	216	0	87.8%	96.8%
Total	17,212	545	236	1	100.0%	100.0%
Commuter Trips	4.30E+06	Commuter Fatalities		2		

CSNF Base Inventory - Region 4 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	0	0	0	0	0.0%	0.0%
Demolition	0	0	0	0	0.0%	0.0%
Unload & Reload	0	0	0	0	0.0%	0.0%
Repair	264	22	10	0	11.1%	2.9%
Surveillance	8,766	263	114	0	88.9%	97.1%
Total	9,030	285	123	0	100.0%	100.0%
Commuter Trips	2.26E+06	Commuter Fatalities		1		

CSNF Base Inventory - Region 5 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	0	0	0	0	0.0%	0.0%
Demolition	0	0	0	0	0.0%	0.0%
Unload & Reload	0	0	0	0	0.0%	0.0%
Repair	195	16	7	0	11.6%	3.1%
Surveillance	6,136	184	79	0	88.4%	96.9%
Total	6,332	200	87	0	100.0%	100.0%
Commuter Trips	1.58E+06	Commuter Fatalities		1		

CSNF Base Inventory - Regional Worker Safety Analysis Summary

Region	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
1	16,428	527	228	1	25.3%	25.1%
2	16,473	530	229	1	25.6%	25.2%
3	17,212	545	236	1	26.0%	26.3%
4	9,030	285	123	0	13.5%	13.8%
5	6,332	200	87	0	9.5%	9.7%
Total	65,475	2,087	903	2	100.0%	100.0%
Commuter Trips	1.64E+07	Commuter Fatalities		6		

CSNF Base Inventory - Region 1 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	600 - 10Ky
Construction	85	53	42	36	32	213
Demolition	85	53	42	36	32	213
Unload & Reload	432	270	214	183	159	1,078
Repair	20	N/A	N/A	N/A	N/A	20
Surveillance	33	12	10	8	7	63
Total CD	655	388	309	264	229	1,337
Total LCFs	0.3	0.2	0.1	0.1	0.1	0.5

CSNF Base Inventory - Region 2 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	600 - 10Ky
Construction	91	57	45	39	34	228
Demolition	91	57	45	39	34	228
Unload & Reload	461	288	229	196	170	1,151
Repair	21	N/A	N/A	N/A	N/A	21
Surveillance	35	13	10	8	7	63
Total CD	700	435	339	282	245	1,605
Total LCFs	0.3	0.2	0.1	0.1	0.1	0.7

CSNF Base Inventory - Region 3 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	600 - 10Ky
Construction	73	46	35	31	27	183
Demolition	73	45	36	31	27	183
Unload & Reload	370	231	184	157	137	924
Repair	17	N/A	N/A	N/A	N/A	17
Surveillance	28	10	8	7	6	54
Total CD	562	333	265	225	197	1,361
Total LCFs	0.2	0.1	0.1	0.1	0.1	0.5

CSNF Base Inventory - Region 4 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	600 - 10Ky
Construction	35	22	17	15	13	87
Demolition	35	22	17	15	13	87
Unload & Reload	176	110	87	74	65	438
Repair	8	N/A	N/A	N/A	N/A	8
Surveillance	13	5	4	3	3	26
Total CD	266	158	126	107	93	645
Total LCFs	0.1	0.1	0.1	0.0	0.0	0.3

CSNF Base Inventory - Region 5 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	600 - 10Ky
Construction	26	16	13	11	9	64
Demolition	26	16	13	11	9	64
Unload & Reload	130	81	66	55	48	324
Repair	6	N/A	N/A	N/A	N/A	6
Surveillance	10	4	3	2	2	19
Total CD	197	117	93	79	69	477
Total LCFs	0.1	0.0	0.0	0.0	0.0	0.2

CSNF Base Inventory - Regional Radworker CD Analysis Summary

Region	100y	200y	300y	400y	500y	600 - 10Ky
1	655	386	309	264	229	1,587
2	700	415	330	282	245	1,695
3	562	333	265	225	197	1,361
4	266	158	126	107	93	645
5	197	117	93	79	69	477
Total CD	2,381	1,410	1,122	958	834	5,765
Total LCFs	1.0	0.6	0.4	0.4	0.3	2.3

CSNF Base Inventory - Regional Public CD Analysis

Region	100y	200y	300y	400y	500y	600 - 10Ky
1	87	54	43	37	32	224
2	93	58	46	39	34	239
3	74	46	37	32	27	192
4	35	22	18	15	13	91
5	26	16	13	11	10	67
Total CD	315	197	157	134	116	813
Total LCFs	0.2	0.1	0.1	0.1	0.1	0.4

CSNF Module 1 Inventory - Region 1 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	0	0	0	0	0.0%	0.0%
Demolition	0	0	0	0	0.0%	0.0%
Unload & Reload	0	0	0	0	0.0%	0.0%
Repair	1,037	85	38	0	21.4%	6.2%
Surveillance	15,779	474	204	0	78.6%	93.8%
Total	16,816	558	242	1	100.0%	100.0%
Commuter Trips	4.20E+06	Commuter Fatalities		2		

CSNF Module 1 Inventory - Region 2 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	0	0	0	0	0.0%	0.0%
Demolition	0	0	0	0	0.0%	0.0%
Unload & Reload	0	0	0	0	0.0%	0.0%
Repair	1,166	95	42	0	23.4%	6.9%
Surveillance	15,779	474	204	0	76.6%	93.1%
Total	16,945	569	247	1	100.0%	100.0%
Commuter Trips	4.24E+06	Commuter Fatalities		2		

CSNF Module 1 Inventory - Region 3 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	0	0	0	0	0.0%	0.0%
Demolition	0	0	0	0	0.0%	0.0%
Unload & Reload	0	0	0	0	0.0%	0.0%
Repair	870	71	32	0	17.8%	5.0%
Surveillance	16,655	500	216	0	82.2%	95.0%
Total	17,525	571	247	1	100.0%	100.0%
Commuter Trips	4.38E+06	Commuter Fatalities		2		

CSNF Module 1 Inventory - Region 4 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	0	0	0	0	0.0%	0.0%
Demolition	0	0	0	0	0.0%	0.0%
Unload & Reload	0	0	0	0	0.0%	0.0%
Repair	521	43	19	0	19.7%	5.6%
Surveillance	8,766	263	114	0	80.3%	94.4%
Total	9,287	306	132	0	100.0%	100.0%
Commuter Trips	2.32E+06	Commuter Fatalities		1		

CSNF Module 1 Inventory - Region 5 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	0	0	0	0	0.0%	0.0%
Demolition	0	0	0	0	0.0%	0.0%
Unload & Reload	0	0	0	0	0.0%	0.0%
Repair	346	28	13	0	18.9%	5.3%
Surveillance	6,136	184	79	0	81.1%	94.7%
Total	6,482	212	92	0	100.0%	100.0%
Commuter Trips	1.62E+06	Commuter Fatalities		1		

CSNF Module 1 Inventory - Regional Worker Safety Analysis Summary

Region	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
1	16,816	558	242	1	25.3%	25.1%
2	16,945	569	247	1	25.9%	25.3%
3	17,525	571	247	1	25.5%	26.1%
4	9,287	306	132	0	13.8%	13.8%
5	6,482	212	92	0	9.5%	9.7%
Total	67,055	2,217	960	2	100.0%	100.0%
Commuter Trips	1.68E+07	Commuter Fatalities		6		

CSNF Module 1 Inventory - Region 1 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	600 - 10Ky
Construction	136	85	88	56	59	340
Demolition	136	85	88	56	60	340
Unload & Reload	690	430	342	292	254	1,721
Repair	31	N/A	N/A	N/A	N/A	31
Surveillance	53	19	16	13	11	101
Total CD	1,046	620	493	421	386	2,633
Total LCFs	0.4	0.2	0.2	0.2	0.1	1.0

CSNF Module 1 Inventory - Region 2 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	600 - 10Ky
Construction	153	96	76	65	57	382
Demolition	153	96	76	65	57	382
Unload & Reload	775	484	389	329	286	1,835
Repair	35	N/A	N/A	N/A	N/A	35
Surveillance	59	22	17	15	13	114
Total CD	1,176	697	558	474	412	2,649
Total LCFs	0.5	0.3	0.2	0.2	0.2	1.1

CSNF Module 1 Inventory - Region 3 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	600 - 10Ky
Construction	114	71	57	49	42	285
Demolition	114	71	57	49	42	285
Unload & Reload	579	351	287	245	213	1,444
Repair	26	N/A	N/A	N/A	N/A	26
Surveillance	44	10	13	11	10	65
Total CD	878	520	414	353	307	2,126
Total LCFs	0.4	0.2	0.2	0.1	0.1	0.9

CSNF Module 1 Inventory - Region 4 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	600 - 10Ky
Construction	68	43	34	29	25	171
Demolition	68	43	34	29	25	171
Unload & Reload	346	218	172	147	128	864
Repair	16	N/A	N/A	N/A	N/A	16
Surveillance	26	10	8	7	6	51
Total CD	525	311	248	211	184	1,272
Total LCFs	0.2	0.1	0.1	0.1	0.1	0.5

CSNF Module 1 Inventory - Region 5 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	600 - 10Ky
Construction	46	28	23	19	17	114
Demolition	46	28	23	19	17	114
Unload & Reload	230	144	114	96	85	574
Repair	10	N/A	N/A	N/A	N/A	10
Surveillance	18	6	5	4	4	34
Total CD	349	207	165	141	122	846
Total LCFs	0.1	0.1	0.1	0.1	0.0	0.3

CSNF Module 1 Inventory - Regional Radworker CD Analysis Summary

Region	100y	200y	300y	400y	500y	600 - 10Ky
1	1,046	520	403	421	356	2,533
2	1,176	697	554	474	412	2,849
3	878	520	414	353	307	2,126
4	525	311	248	211	184	1,272
5	349	207	165	141	122	846
Total CD	3,975	2,355	1,873	1,600	1,382	9,525
Total LCFs	1.6	0.9	0.7	0.6	0.6	3.6

CSNF Module 1 Inventory - Regional Public CD Analysis

Region	100y	200y	300y	400y	500y	600 - 10Ky
1	139	86	69	59	51	357
2	156	97	77	66	57	402
3	116	78	68	49	43	300
4	70	43	35	29	25	179
5	46	29	23	20	17	119
Total CD	526	328	261	223	194	1,357
Total LCFs	0.3	0.2	0.1	0.1	0.1	0.7

Task	DSNF DSC Caretaker FTE Loading				Recurrence Frequency	Recurrence FTE
	Workers	Duration	Wrkr-Hrs	FTE		
Construction	No Data	No Data	1,500	0.75 per DSC	0	0.00
Demolition	No Data	No Data	182	0.091 per DSC	0	0.00
Unload & Reload	No Data	No Data	16.66	0.0083 per DSC	0	0.00
Repair	No Data	No Data	750	0.38 per DSC	1	0.38
Surveillance	2	1	17,532	8.77 per Site	100	877

DSNF Base Inventory - Region 2 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	0	0	0	0	0.0%	0.0%
Demolition	0	0	0	0	0.0%	0.0%
Unload & Reload	0	0	0	0	0.0%	0.0%
Repair	63	5	2	0	22.9%	6.7%
Surveillance	877	26	11	0	77.1%	93.3%
Total	940	31	14	0	100.0%	100.0%
Commuter Trips	2.35E+05	Commuter Fatalities		0		

DSNF Base Inventory - Region 5 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	0	0	0	0	0.0%	0.0%
Demolition	0	0	0	0	0.0%	0.0%
Unload & Reload	0	0	0	0	0.0%	0.0%
Repair	63	5	2	0	12.9%	3.4%
Surveillance	1,753	53	23	0	87.1%	96.6%
Total	1,816	58	25	0	100.0%	100.0%
Commuter Trips	4.54E+05	Commuter Fatalities		0		

DSNF Base Inventory - Regional Worker Safety Analysis Summary

Region	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
2	940	31	14	0	36.1%	34.1%
5	1,816	58	25	0	63.9%	65.9%
Total	2,755	89	39	0	100.0%	100.0%
Commuter Trips	6.89E+05	Commuter Fatalities		0		

DSNF Module 1 Inventory - Region 2 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	0	0	0	0	0.0%	0.0%
Demolition	0	0	0	0	0.0%	0.0%
Unload & Reload	0	0	0	0	0.0%	0.0%
Repair	76	6	3	0	26.3%	8.0%
Surveillance	877	26	11	0	73.7%	92.0%
Total	952	33	14	0	100.0%	100.0%
Commuter Trips	2.38E+05	Commuter Fatalities		0		

DSNF Module 1 Inventory - Region 5 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	0	0	0	0	0.0%	0.0%
Demolition	0	0	0	0	0.0%	0.0%
Unload & Reload	0	0	0	0	0.0%	0.0%
Repair	196	16	7	0	23.5%	6.9%
Surveillance	2,630	79	34	0	76.5%	93.1%
Total	2,826	95	41	0	100.0%	100.0%
Commuter Trips	7.06E+05	Commuter Fatalities		0		

DSNF Module 1 Inventory - Regional Worker Safety Analysis Summary

Region	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
2	952	33	14	0	25.7%	25.2%
5	2,826	95	41	0	74.3%	74.8%
Total	3,778	127	55	0	100.0%	100.0%
Commuter Trips	9.44E+05	Commuter Fatalities		0		

DSNF Base Inventory - Region 2 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	600 - 10Ky
Construction	8	5	4	4	3	21
Demolition	8	5	4	4	3	21
Unload & Reload	42	26	21	18	16	105
Repair	2	N/A	N/A	N/A	N/A	2
Surveillance	3	1	1	1	1	6
Total CD	64	38	30	26	22	154
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.1

DSNF Base Inventory - Region 5 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	600 - 10Ky
Construction	8	5	4	3	3	21
Demolition	8	5	4	3	3	21
Unload & Reload	42	26	21	18	16	104
Repair	2	N/A	N/A	N/A	N/A	2
Surveillance	3	1	1	1	1	6
Total CD	63	37	30	25	22	153
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.1

DSNF Base Inventory - Regional Radworker CD Analysis Summary

Region	100y	200y	300y	400y	500y	600 - 10Ky
1	64	38	30	26	22	154
2	63	37	30	25	22	153
Total CD	127	75	60	51	44	307
Total LCFs	0.1	0.0	0.0	0.0	0.0	0.1

DSNF Module 1 Inventory - Region 1 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	600 - 10Ky
Construction	10	6	5	4	4	25
Demolition	10	6	5	4	4	25
Unload & Reload	50	31	25	21	19	125
Repair	2	N/A	N/A	N/A	N/A	2
Surveillance	4	1	1	1	1	7
Total CD	76	45	36	31	27	185
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.1

DSNF Module 1 Inventory - Region 2 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	600 - 10Ky
Construction	26	16	13	11	9	64
Demolition	26	16	13	11	9	64
Unload & Reload	130	61	65	55	48	325
Repair	6	N/A	N/A	N/A	N/A	6
Surveillance	10	4	3	2	2	19
Total CD	198	117	93	80	69	475
Total LCFs	0.1	0.0	0.0	0.0	0.0	0.2

DSNF Module 1 Inventory - Regional Radworker CD Analysis Summary

Region	100y	200y	300y	400y	500y	600 - 10Ky
1	76	45	36	31	27	185
2	198	117	93	80	69	475
Total CD	274	162	129	110	96	660
Total LCFs	0.1	0.1	0.1	0.0	0.0	0.3

Task	HLW DSC Caretaker FTE Loading				Recurrence Frequency	Recurrence FTE
	Workers	Duration	Wrkr-Hrs	FTE		
Construction	No Data	No Data	1,069	0.53 per DSC	0	0.00
Demolition	No Data	No Data	130	0.065 per DSC	0	0.00
Unload & Reload	No Data	No Data	130	0.065 per DSC	0	0.00
Repair	No Data	No Data	222	0.111 per DSC	1	0.11
Surveillance	2	1	17,532	8.77 per Site	100	877

HLW Base Inventory - Region 1 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	0	0	0	0	0.0%	0.0%
Demolition	0	0	0	0	0.0%	0.0%
Unload & Reload	0	0	0	0	0.0%	0.0%
Repair	8	1	0	0	3.8%	0.9%
Surveillance	877	26	11	0	96.2%	99.1%
Total	885	27	12	0	100.0%	100.0%
Commuter Trips	2.21E+05	Commuter Fatalities		0		

HLW Base Inventory - Region 2 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	0	0	0	0	0.0%	0.0%
Demolition	0	0	0	0	0.0%	0.0%
Unload & Reload	0	0	0	0	0.0%	0.0%
Repair	668	55	24	0	61.2%	27.6%
Surveillance	1,753	53	23	0	38.8%	72.4%
Total	2,422	107	47	0	100.0%	100.0%
Commuter Trips	6.05E+05	Commuter Fatalities		0		

HLW Base Inventory - Region 5 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	0	0	0	0	0.0%	0.0%
Demolition	0	0	0	0	0.0%	0.0%
Unload & Reload	0	0	0	0	0.0%	0.0%
Repair	221	18	8	0	51.1%	20.2%
Surveillance	877	26	11	0	48.9%	79.8%
Total	1,098	44	19	0	100.0%	100.0%
Commuter Trips	2.74E+05	Commuter Fatalities		0		

HLW Base Inventory - Regional Worker Safety Analysis Summary

Region	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
1	885	27	12	0	14.4%	25.1%
2	2,422	107	47	0	71.6%	68.8%
5	1,098	44	19	0	28.4%	31.2%
Total	3,519	152	66	0	100.0%	100.0%
Commuter Trips	8.80E+05	Commuter Fatalities		0		

HLW Module 1 Inventory - Region 1 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	0	0	0	0	0.0%	0.0%
Demolition	0	0	0	0	0.0%	0.0%
Unload & Reload	0	0	0	0	0.0%	0.0%
Repair	8	1	0	0	3.8%	0.9%
Surveillance	877	26	11	0	96.2%	99.1%
Total	885	27	12	0	100.0%	100.0%
Commuter Trips	2.21E+05	Commuter Fatalities		0		

HLW Module 1 Inventory - Region 2 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	0	0	0	0	0.0%	0.0%
Demolition	0	0	0	0	0.0%	0.0%
Unload & Reload	0	0	0	0	0.0%	0.0%
Repair	687	56	25	0	61.8%	28.1%
Surveillance	1,753	53	23	0	38.2%	71.9%
Total	2,440	109	48	0	100.0%	100.0%
Commuter Trips	6.10E+05	Commuter Fatalities		0		

HLW Module 1 Inventory - Region 5 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	0	0	0	0	0.0%	0.0%
Demolition	0	0	0	0	0.0%	0.0%
Unload & Reload	0	0	0	0	0.0%	0.0%
Repair	1,753	143	63	0	58.0%	25.0%
Surveillance	5,260	158	68	0	42.0%	75.0%
Total	7,013	301	132	0	100.0%	100.0%
Commuter Trips	1.75E+06	Commuter Fatalities		1		

HLW Module 1 Inventory - Regional Worker Safety Analysis Summary

Region	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
1	885	27	12	0	5.3%	9.4%
2	2,440	109	48	0	26.9%	25.8%
5	7,013	301	132	0	73.1%	74.2%
Total	9,453	410	179	0	100.0%	100.0%
Commuter Trips	2.36E+06	Commuter Fatalities		1		

HLW Base Inventory - Region 1 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	600 - 10Ky
Construction	0	0	0	0	0	0
Demolition	0	0	0	0	0	0
Unload & Reload	0	0	0	0	0	0.1
Repair	0.3	N/A	N/A	N/A	N/A	0.0
Surveillance	1	0.0	0.0	0	0	1
Total CD	1	0.2	0.1	0	0	2
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.0

HLW Base Inventory - Region 2 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	600 - 10Ky
Construction	0	0	0	0	0	0
Demolition	0	0	0	0	0	0
Unload & Reload	0	11	5	3	2	11
Repair	22	N/A	N/A	N/A	N/A	22
Surveillance	93	3	1	1	1	97
Total CD	115	14	6	4	3	130
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.1

HLW Base Inventory - Region 5 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	600 - 10Ky
Construction	0	0	0	0	0	0
Demolition	0	0	0	0	0	0
Unload & Reload	0	4	2	1	1	4
Repair	7	N/A	N/A	N/A	N/A	7
Surveillance	31	1	0	0	0	32
Total CD	38	5	2	1	1	43
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.0

HLW Base Inventory - Regional Radworker CD Analysis Summary

Region	100y	200y	300y	400y	500y	600 - 10Ky
1	1	0	0	0	0	2
2	115	14	6	4	3	130
5	38	5	2	1	1	43
Total CD	154	19	9	6	4	174
Total LCFs	0.1	0.0	0.0	0.0	0.0	0

HLW Module 1 Inventory - Region 1 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	600 - 10Ky
Construction	0	0	0	0	0	0
Demolition	0	0	0	0	0	0
Unload & Reload	0	0	0	0	0	0
Repair	0	N/A	N/A	N/A	N/A	0
Surveillance	1	0	0	0	0	1
Total CD	1	0	0	0	0	2
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.0

HLW Module 1 Inventory - Region 2 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	600 - 10Ky
Construction	0	0	0	0	0	0
Demolition	0	0	0	0	0	0
Unload & Reload	0	11	5	3	3	12
Repair	22	N/A	N/A	N/A	N/A	22
Surveillance	96	9	1	1	1	99
Total CD	118	14	7	4	5	133
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.1

HLW Module 1 Inventory - Region 5 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	600 - 10Ky
Construction	0	0	0	0	0	0
Demolition	0	0	0	0	0	0
Unload & Reload	0	20	13	9	5	90
Repair	57	N/A	N/A	N/A	N/A	57
Surveillance	245	7	5	2	2	254
Total CD	302	35	17	11	6	341
Total LCFs	0.1	0.0	0.0	0.0	0.0	0.1

HLW Module 1 Inventory - Regional Radworker CD Analysis Summary

Region	100y	200y	300y	400y	500y	600 - 10Ky
1	1	0	0	0	0	2
2	118	14	7	4	5	133
5	302	35	17	11	6	341
Total CD	421	51	24	15	11	476
Total LCFs	0.2	0.0	0.0	0.0	0.0	0

CSNF Base Inventory - Demolition Rubble Analysis

Region	Rubble Volume, m ³	Truck Loads	Traffic Fatalities	Emissions Fatalities
1	0.00E+00	0.00E+00	0.0	0.000
2	0.00E+00	0.00E+00	0.0	0.000
3	0.00E+00	0.00E+00	0.0	0.000
4	0.00E+00	0.00E+00	0.0	0.000
5	0.00E+00	0.00E+00	0.0	0.000
Total	0.00E+00	0.00E+00	0.0	0.00

Haul Distance 0.00E+00 km

DSNF Base Inventory - Demolition Rubble Analysis

Region	Rubble Volume, m ³	Truck Loads	Traffic Fatalities	Emissions Fatalities
2	0.00E+00	0.00E+00	0.0	0.0000
5	0.00E+00	0.00E+00	0.0	0.0000
Total	0.00E+00	0.00E+00	0.0	0.0000

Haul Distance 0.00E+00 km

HLW Base Inventory - Demolition Rubble Analysis

Region	Rubble Volume, m ³	Truck Loads	Traffic Fatalities	Emissions Fatalities	HLWRPRV
1	1.27E+02	2.43E+01	0.000	0.00000	1.69
2	1.02E+04	1.95E+03	0.0	0.0000	HLWRPload
5	3.37E+03	6.46E+02	0.00	0.0000	0.32
Total	1.37E+04	2.62E+03	0.0	0.0000	

Haul Distance 2.11E+05 km

All Base Inventories - Demolition Rubble Analysis Summary

Region	Rubble Volume, m ³	Truck Loads	Traffic Fatalities	Emissions Fatalities
1	1.27E+02	2.43E+01	0.0	0.000
2	1.02E+04	1.95E+03	0.0	0.000
3	0.00E+00	0.00E+00	0.0	0.000
4	0.00E+00	0.00E+00	0.0	0.000
5	3.37E+03	6.46E+02	0.0	0.000
Total	1.37E+04	2.62E+03	0.0	0.00

Haul Distance 2.11E+05 km

CSNF Module 1 Inventory - Demolition Rubble Analysis

Region	Rubble Volume, m ³	Truck Loads	Traffic Fatalities	Emissions Fatalities
1	0.00E+00	0.00E+00	0.0	0.000
2	0.00E+00	0.00E+00	0.0	0.000
3	0.00E+00	0.00E+00	0.0	0.000
4	0.00E+00	0.00E+00	0.0	0.000
5	0.00E+00	0.00E+00	0.0	0.000
Total	0.00E+00	0.00E+00	0.0	0.00
	Haul Distance	0.00E+00 km		

DSNF Module 1 Inventory - Demolition Rubble Analysis

Region	Rubble Volume, m ³	Truck Loads	Traffic Fatalities	Emissions Fatalities
2	0.00E+00	0.00E+00	0.0	0.0000
5	0.00E+00	0.00E+00	0.0	0.000
Total	0.00E+00	0.00E+00	0.0	0.000
	Haul Distance	0.00E+00 km		

HLW Module 1 Inventory - Demolition Rubble Analysis

Region	Rubble Volume, m ³	Truck Loads	Traffic Fatalities	Emissions Fatalities
1	1.27E+02	2.43E+01	0.000	0.000000
2	1.05E+04	2.01E+03	0.0	0.0000
5	2.67E+04	5.12E+03	0.0	0.000
Total	3.73E+04	7.15E+03	0.0	0.000
	Haul Distance	5.75E+05 km		

All Module 1 Inventories - Demolition Rubble Analysis Summary

Region	Rubble Volume, m ³	Truck Loads	Traffic Fatalities	Emissions Fatalities
1	1.27E+02	2.43E+01	0.0	0.000
2	1.05E+04	2.01E+03	0.0	0.000
3	0.00E+00	0.00E+00	0.0	0.000
4	0.00E+00	0.00E+00	0.0	0.000
5	2.67E+04	5.12E+03	0.0	0.000
Total	3.73E+04	7.15E+03	0.0	0.00
	Haul Distance	5.75E+05 km		

Controlled Storage During an Initial 100 Years			
<i>Total of Inventory Class</i>	Base	Module 1	Difference
Fatalities			
Industrial incident fatalities	2.4	2.9	0.5
Radiation LCFs, public	0.16	0.26	0.11
Radiation LCFs, workers	1.1	1.9	0.8
Commuter accident fatalities	6.6	7.4	0.8
Trucking accident fatalities	0.0	0.0	0.0
Trucking LCFs (emissions)	0.0	0.0	0.0
Total Fatalities	10.3	12.5	2.3
Other Impacts			
FTE worker-years	71,750	80,285	8,535
Worker population (all-site average)	1,435	1,606	171
Worker population (single-site average)	9.1	9.4	0.4
Total recordable injury/illness cases	2,328	2,754	426
Lost workday cases	1,008	1,194	187
Commuter round trips	1.8E+07	2.0E+07	2.1E+06
Demolition rubble volume, m ³	13,687	37,312	23,626
Collective dose, person-rem (public)	315	526	211
Collective dose, person-rem (workers)	2,662	4,670	2,008

Impacts Summary

Attachment C

10,000-Year Health, Safety, and Environmental Impacts Calculations

Reference HLW Case

CSNF Inventory - Base		
Region	Sites	DSCs
1	18	1,732
2	18	1,850
3	19	1,485
4	10	704
5	7	521
Subtotal	72	6,292

DSNF Inventory - Base		
Region	Sites	DSCs
2 SRS	1	168
5 Hanford	0	0
5 INEEL	1	119
5 Navy	0	0
5 FSVrain	1	48
Subtotal	3	335

HLW Inventory - Base		
Region	Sites	DSCs
1 WVDP	1	75
2 SRS	2	6,022
5 Hanford	1	1,993
5 INEEL	0	0
Subtotal	4	8,090

Total	79	14,717
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CSNF Inventory - Module 1		
Region	Sites	DSCs
1	18	2,765
2	18	3,109
3	19	2,320
4	10	1,388
5	7	923
Subtotal	72	10,505

DSNF Inventory - Module 1		
Region	Sites	DSCs
2 SRS	1	202
5 Hanford	0	0
5 INEEL	1	174
5 Navy	1	300
5 FSVrain	1	48
Subtotal	4	724

HLW Inventory - Module 1		
Region	Sites	DSCs
1 WVDP	1	75
2 SRS	2	6,188
5 Hanford	5	14,500
5 INEEL	1	1,292
Subtotal	9	22,055

Total	85	33,284
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<u>Parameter 'Name'</u>	<u>Value</u>
FTE	2,000 worker-hours/FTE
TRC _c	0.082 case/FTE
LWC _c	0.036 case/FTE
ISF _c	0.00012 fatality/FTE
TRC _o	0.030 case/FTE
LWC _o	0.013 case/FTE
ISF _o	0.000029 fatality/FTE
TRIPHR	8 worker-hours/round trip
CMTRF	3.70E-07 commuter fatality/round trip
SNFRBL	17.6 truck loads rubble/SNF DSC demolished
HLWRBL	4 truck loads rubble/HLW DSC demolished
TRIPRBL	80.5 (round trip) km/truck load
TRKRF	1.78E-06 trucking fatality/truck load
TRKRLCF	5.79E-09 emissions fatality/truck load
SNFRBLV	92.05 m ³ rubble/SNF DSC demolished
HLWRBLV	19.06 m ³ rubble/HLW DSC demolished
Radiological Parameters	
LCF _w	0.0004 LCF/person-rem (worker)
LCF _p	0.0005 LCF/person-rem (public)
SNFCNSTCD	0.17 person-rem/SNF DSC constructed
SNFDMLSCD	0.17 person-rem/SNF DSC demolished
SNFLDRLDCD	0.86 person-rem/SNF DSC unloaded & reloaded
SNFREPRCD	0.039 person-rem/SNF DSC repaired
SNFSURVCD	0.0004 person-rem/year per SNF DSC surveilled
SDRF ₁	0.290 SNF dose rate (reduction) factor (t = 100y)
SDRF ₂	0.181 SNF dose rate (reduction) factor (t = 200y)
SDRF ₃	0.144 SNF dose rate (reduction) factor (t = 300y)
SDRF ₄	0.123 SNF dose rate (reduction) factor (t = 400y)
SDRF ₅	0.107 SNF dose rate (reduction) factor (t = 500y)
SDRF ₁₀₀	0.024 SNF dose rate (reduction) factor (t = 600 - 10,000y)
SDRF _{surv}	0.50 SNF dose rate (reduction) factor (t = 0 - 100y)
HLWCNSTCD	0 person-rem/HLW DSC constructed
HLWDMLSCD	0 person-rem/HLW DSC demolished
HLWLDRLDCD	0.465 person-rem/HLW DSC unloaded & reloaded
HLWREPRCD	0.245 person-rem/HLW DSC repaired
HLWSURVCD	0.0012 person-rem/year per HLW DSC surveilled
HDRF ₁	0.015 HLW dose rate (reduction) factor (t = 100y)
HDRF ₂	0.004 HLW dose rate (reduction) factor (t = 200y)
HDRF ₃	0.002 HLW dose rate (reduction) factor (t = 300y)
HDRF ₄	0.0012 HLW dose rate (reduction) factor (t = 400y)
HDRF ₅	0.0009 HLW dose rate (reduction) factor (t = 500y)
HDRF ₁₀₀	0.001 HLW dose rate (reduction) factor (t = 600 - 10,000y)
HDRF _{surv}	0.129 HLW dose rate (reduction) factor (t = 0 - 100y)
PUBDOSE	0.002 (public) person-rem/year/CSNF DSC maintained

Task	CSNF DSC Caretaker FTE Loading				Recurrence Frequency	Recurrence FTE
	Workers	Duration	Wrkr-Hrs	FTE		
Construction	No Data	No Data	1,500	0.75 per DSC	100	75.00
Demolition	No Data	No Data	182	0.091 per DSC	99	9.03
Unload & Reload	No Data	No Data	16.66	0.0083 per DSC	100	0.83
Repair	No Data	No Data	750	0.38 per DSC	1	0.38
Surveillance	2	1	17,532	8.77 per Site	10,000	87,660

CSNF Base Inventory - Region 1 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	129,900	10,631	4,705	16	24.6%	7.5%
Demolition	15,640	1,280	567	2	3.0%	0.9%
Unload & Reload	1,443	43	19	0	0.1%	0.1%
Repair	650	53	24	0	0.1%	0.0%
Surveillance	1,577,880	47,355	20,431	46	72.2%	91.4%
Total	1,725,512	59,363	25,745	63	100.0%	100.0%
Commuter Trips	4.31E+08	Commuter Fatalities		160		

CSNF Base Inventory - Region 2 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	138,750	11,355	5,026	17	25.8%	8.0%
Demolition	16,705	1,367	605	2	3.1%	1.0%
Unload & Reload	1,541	46	20	0	0.1%	0.1%
Repair	694	57	25	0	0.1%	0.0%
Surveillance	1,577,880	47,355	20,431	46	70.9%	90.9%
Total	1,735,570	60,181	26,107	65	100.0%	100.0%
Commuter Trips	4.34E+08	Commuter Fatalities		161		

CSNF Base Inventory - Region 3 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	111,375	9,115	4,034	13	21.1%	6.2%
Demolition	13,410	1,097	486	2	2.5%	0.7%
Unload & Reload	1,237	37	16	0	0.1%	0.1%
Repair	557	46	20	0	0.1%	0.0%
Surveillance	1,665,540	49,986	21,566	48	76.2%	92.9%
Total	1,792,118	60,281	26,122	63	100.0%	100.0%
Commuter Trips	4.48E+08	Commuter Fatalities		166		

CSNF Base Inventory - Region 4 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	52,800	4,321	1,913	6	19.5%	5.6%
Demolition	6,357	520	230	1	2.3%	0.7%
Unload & Reload	586	18	8	0	0.1%	0.1%
Repair	264	22	10	0	0.1%	0.0%
Surveillance	876,600	26,309	11,350	25	78.1%	93.6%
Total	936,608	31,189	13,510	33	100.0%	100.0%
Commuter Trips	2.34E+08	Commuter Fatalities		87		

CSNF Base Inventory - Region 5 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	39,075	3,198	1,415	5	20.3%	5.9%
Demolition	4,705	385	170	1	2.4%	0.7%
Unload & Reload	434	13	6	0	0.1%	0.1%
Repair	195	16	7	0	0.1%	0.0%
Surveillance	613,620	18,416	7,945	18	77.1%	93.3%
Total	658,029	22,028	9,544	23	100.0%	100.0%
Commuter Trips	1.65E+08	Commuter Fatalities		61		

CSNF Base Inventory - Regional Worker Safety Analysis Summary

Region	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
1	1,725,512	59,363	25,745	63	25.7%	25.2%
2	1,735,570	60,181	26,107	65	26.1%	25.3%
3	1,792,118	60,281	26,122	63	25.7%	26.2%
4	936,608	31,189	13,510	33	13.2%	13.7%
5	658,029	22,028	9,544	23	9.3%	9.6%
Total	6,847,837	233,042	101,028	247	100.0%	100.0%
Commuter Trips	1.71E+09	Commuter Fatalities		633		

CSNF Base Inventory - Region 1 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	85	53	42	36	32	928
Demolition	85	53	42	36	32	921
Unload & Reload	432	270	214	183	159	4,695
Repair	20	N/A	N/A	N/A	N/A	20
Surveillance	33	12	10	8	7	223
Total CD	655	388	309	264	229	6,787
Total LCFs	0.3	0.2	0.1	0.1	0.1	2.7

CSNF Base Inventory - Region 2 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	91	57	45	39	34	991
Demolition	91	57	45	39	34	984
Unload & Reload	461	288	229	196	170	5,015
Repair	21	N/A	N/A	N/A	N/A	21
Surveillance	35	13	10	9	8	238
Total CD	700	415	330	282	245	7,250
Total LCFs	0.3	0.2	0.1	0.1	0.1	2.9

CSNF Base Inventory - Region 3 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	73	46	36	31	27	796
Demolition	73	46	36	31	27	790
Unload & Reload	370	231	184	157	137	4,026
Repair	17	N/A	N/A	N/A	N/A	17
Surveillance	28	10	8	7	6	191
Total CD	562	333	265	226	197	5,819
Total LCFs	0.2	0.1	0.1	0.1	0.1	2.3

CSNF Base Inventory - Region 4 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	35	22	17	15	13	377
Demolition	35	22	17	15	13	374
Unload & Reload	176	110	87	74	65	1,909
Repair	8	N/A	N/A	N/A	N/A	8
Surveillance	13	5	4	3	3	91
Total CD	266	158	126	107	93	2,759
Total LCFs	0.1	0.1	0.1	0.0	0.0	1.1

CSNF Base Inventory - Region 5 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	26	16	13	11	9	279
Demolition	26	16	13	11	9	277
Unload & Reload	130	81	65	55	48	1,412
Repair	6	N/A	N/A	N/A	N/A	6
Surveillance	10	4	3	2	2	67
Total CD	197	117	93	79	69	2,042
Total LCFs	0.1	0.0	0.0	0.0	0.0	0.8

CSNF Base Inventory - Regional Radworker CD Analysis Summary

Region	100y	200y	300y	400y	500y	100 - 10Ky
1	655	388	309	264	229	6,787
2	700	415	330	282	245	7,250
3	562	333	265	226	197	5,819
4	266	158	126	107	93	2,759
5	197	117	93	79	69	2,042
Total CD	2,381	1,410	1,122	958	834	24,657
Total LCFs	1.0	0.6	0.4	0.4	0.3	9.9

CSNF Base Inventory - Regional Public CD Analysis

Region	100y	200y	300y	400y	500y	100 - 10Ky
1	87	54	43	37	32	979
2	93	58	46	39	34	1,046
3	74	46	37	32	27	840
4	35	22	18	15	13	398
5	26	16	13	11	10	295
Total CD	315	197	157	134	116	3,557
Total LCFs	0.2	0.1	0.1	0.1	0.1	1.8

CSNF Module 1 Inventory - Region 1 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	207,375	16,972	7,512	25	33.7%	11.4%
Demolition	24,968	2,043	904	3	4.1%	1.4%
Unload & Reload	2,303	69	30	0	0.1%	0.1%
Repair	1,037	85	38	0	0.2%	0.1%
Surveillance	1,577,880	47,355	20,431	46	62.0%	87.0%
Total	1,813,563	66,524	28,914	74	100.0%	100.0%
Commuter Trips	4.53E+08	Commuter Fatalities		168		

CSNF Module 1 Inventory - Region 2 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	233,175	19,083	8,446	28	36.2%	12.7%
Demolition	28,074	2,298	1,017	3	4.4%	1.5%
Unload & Reload	2,590	78	34	0	0.1%	0.1%
Repair	1,166	95	42	0	0.2%	0.1%
Surveillance	1,577,880	47,355	20,431	46	59.2%	85.6%
Total	1,842,885	68,909	29,970	77	100.0%	100.0%
Commuter Trips	4.61E+08	Commuter Fatalities		170		

CSNF Module 1 Inventory - Region 3 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	174,000	14,240	6,303	21	29.1%	9.3%
Demolition	20,950	1,715	759	3	3.5%	1.1%
Unload & Reload	1,933	58	25	0	0.1%	0.1%
Repair	870	71	32	0	0.1%	0.0%
Surveillance	1,665,540	49,986	21,566	48	67.2%	89.4%
Total	1,863,292	66,070	28,684	72	100.0%	100.0%
Commuter Trips	4.66E+08	Commuter Fatalities		172		

CSNF Module 1 Inventory - Region 4 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	104,100	8,520	3,771	12	31.6%	10.5%
Demolition	12,534	1,026	454	2	3.8%	1.3%
Unload & Reload	1,156	35	15	0	0.1%	0.1%
Repair	521	43	19	0	0.2%	0.1%
Surveillance	876,600	26,309	11,350	25	64.3%	88.1%
Total	994,910	35,931	15,609	40	100.0%	100.0%
Commuter Trips	2.49E+08	Commuter Fatalities		92		

CSNF Module 1 Inventory - Region 5 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	69,225	5,665	2,508	8	30.6%	10.0%
Demolition	8,335	682	302	1	3.7%	1.2%
Unload & Reload	769	23	10	0	0.1%	0.1%
Repair	346	28	13	0	0.2%	0.0%
Surveillance	613,620	18,416	7,945	18	65.5%	88.6%
Total	692,295	24,815	10,777	27	100.0%	100.0%
Commuter Trips	1.73E+08	Commuter Fatalities		64		

CSNF Module 1 Inventory - Regional Worker Safety Analysis Summary

Region	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
1	1,813,563	66,524	28,914	74	25.5%	25.2%
2	1,842,885	68,909	29,970	77	26.7%	25.6%
3	1,863,292	66,070	28,684	72	24.8%	25.9%
4	994,910	35,931	15,609	40	13.6%	13.8%
5	692,295	24,815	10,777	27	9.4%	9.6%
Total	7,206,945	262,250	113,955	290	100.0%	100.0%
Commuter Trips	1.80E+09	Commuter Fatalities		667		

CSNF Module 1 Inventory - Region 1 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	136	85	68	58	50	1,482
Demolition	136	85	68	58	50	1,470
Unload & Reload	690	430	342	292	254	7,496
Repair	31	N/A	N/A	N/A	N/A	31
Surveillance	53	19	15	13	11	356
Total CD	1,046	620	493	421	366	10,835
Total LCFs	0.4	0.2	0.2	0.2	0.1	4.3

CSNF Module 1 Inventory - Region 2 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	153	96	76	65	57	1,666
Demolition	153	96	76	65	57	1,653
Unload & Reload	775	484	385	329	286	8,428
Repair	35	N/A	N/A	N/A	N/A	35
Surveillance	59	22	17	15	13	400
Total CD	1,176	697	554	474	412	12,183
Total LCFs	0.5	0.3	0.2	0.2	0.2	4.9

CSNF Module 1 Inventory - Region 3 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	114	71	57	49	42	1,243
Demolition	114	71	57	49	42	1,234
Unload & Reload	579	361	287	245	213	6,289
Repair	26	N/A	N/A	N/A	N/A	26
Surveillance	44	16	13	11	10	299
Total CD	878	520	414	353	307	9,091
Total LCFs	0.4	0.2	0.2	0.1	0.1	3.6

CSNF Module 1 Inventory - Region 4 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	68	43	34	29	25	744
Demolition	68	43	34	29	25	738
Unload & Reload	346	216	172	147	128	3,763
Repair	16	N/A	N/A	N/A	N/A	16
Surveillance	26	10	8	7	6	179
Total CD	525	311	248	211	184	5,439
Total LCFs	0.2	0.1	0.1	0.1	0.1	2.2

CSNF Module 1 Inventory - Region 5 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	46	28	23	19	17	495
Demolition	46	28	23	19	17	491
Unload & Reload	230	144	114	98	85	2,502
Repair	10	N/A	N/A	N/A	N/A	10
Surveillance	18	6	5	4	4	119
Total CD	349	207	165	141	122	3,617
Total LCFs	0.1	0.1	0.1	0.1	0.0	1.4

CSNF Module 1 Inventory - Regional Radworker CD Analysis Summary

Region	100y	200y	300y	400y	500y	100 - 10Ky
1	1,046	620	493	421	366	10,835
2	1,176	697	554	474	412	12,183
3	878	520	414	353	307	9,091
4	525	311	248	211	184	5,439
5	349	207	165	141	122	3,617
Total CD	3,975	2,355	1,873	1,600	1,392	41,166
Total LCFs	1.6	0.9	0.7	0.6	0.6	16.5

CSNF Module 1 Inventory - Regional Public CD Analysis

Region	100y	200y	300y	400y	500y	100 - 10Ky
1	139	86	69	59	51	1,563
2	156	97	77	66	57	1,758
3	116	73	58	49	43	1,312
4	70	43	35	29	26	785
5	46	29	23	20	17	522
Total CD	526	328	261	223	194	5,939
Total LCFs	0.3	0.2	0.1	0.1	0.1	3.0

Task	DSNF DSC Caretaker FTE Loading				Recurrence	Recurrence
	Workers	Duration	Wrkr-Hrs	FTE	Frequency	FTE
Construction	No Data	No Data	1,500	0.75 per DSC	100	75.00
Demolition	No Data	No Data	182	0.091 per DSC	99	9.03
Unload & Reload	No Data	No Data	16.66	0.0083 per DSC	100	0.83
Repair	No Data	No Data	750	0.38 per DSC	1	0.38
Surveillance	2	1	17,532	8.77 per Site	10,000	87,660

DSNF Base Inventory - Region 2 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	12,600	1,031	456	2	35.6%	12.4%
Demolition	1,517	124	55	0	4.3%	1.5%
Unload & Reload	140	4	2	0	0.1%	0.1%
Repair	63	5	2	0	0.2%	0.1%
Surveillance	87,660	2,631	1,135	3	59.8%	86.0%
Total	101,980	3,796	1,651	4	100.0%	100.0%
Commuter Trips	2.55E+07	Commuter Fatalities		9		

DSNF Base Inventory - Region 5 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	12,525	1,025	454	2	22.2%	6.6%
Demolition	1,508	123	55	0	2.7%	0.8%
Unload & Reload	139	4	2	0	0.1%	0.1%
Repair	63	5	2	0	0.1%	0.0%
Surveillance	175,320	5,262	2,270	5	75.0%	92.5%
Total	189,555	6,419	2,782	7	100.0%	100.0%
Commuter Trips	4.74E+07	Commuter Fatalities		18		

DSNF Base Inventory - Regional Worker Safety Analysis Summary

Region	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
2	101,980	3,796	1,651	4	38.5%	35.0%
5	189,555	6,419	2,782	7	61.5%	65.0%
Total	291,535	10,215	4,433	11	100.0%	100.0%
Commuter Trips	7.29E+07	Commuter Fatalities		27		

DSNF Module 1 Inventory - Region 2 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	15,150	1,240	549	2	39.9%	14.4%
Demolition	1,824	124	55	0	4.0%	1.7%
Unload & Reload	168	5	2	0	0.1%	0.2%
Repair	76	6	3	0	0.2%	0.1%
Surveillance	87,660	2,631	1,135	3	55.8%	83.6%
Total	104,878	4,006	1,744	5	100.0%	100.0%
Commuter Trips	2.62E+07	Commuter Fatalities		10		

DSNF Module 1 Inventory - Region 5 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	39,150	3,204	1,418	5	36.3%	12.7%
Demolition	4,714	386	171	1	4.4%	1.5%
Unload & Reload	435	13	6	0	0.1%	0.1%
Repair	196	16	7	0	0.2%	0.1%
Surveillance	262,980	7,893	3,405	8	59.0%	85.5%
Total	307,474	11,511	5,007	13	100.0%	100.0%
Commuter Trips	7.69E+07	Commuter Fatalities		28		

DSNF Module 1 Inventory - Regional Worker Safety Analysis Summary

Region	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
2	104,878	4,006	1,744	5	26.1%	25.4%
5	307,474	11,511	5,007	13	73.9%	74.6%
Total	412,352	15,518	6,750	17	100.0%	100.0%
Commuter Trips	1.03E+08	Commuter Fatalities		38		

DSNF Base Inventory - Region 2 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	8	5	4	4	3	90
Demolition	8	5	4	4	3	89
Unload & Reload	42	26	21	18	15	455
Repair	2	N/A	N/A	N/A	N/A	2
Surveillance	3	1	1	1	1	22
Total CD	64	38	30	26	22	658
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.3

DSNF Base Inventory - Region 5 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	8	5	4	3	3	89
Demolition	8	5	4	3	3	89
Unload & Reload	42	26	21	18	15	453
Repair	2	N/A	N/A	N/A	N/A	2
Surveillance	3	1	1	1	1	22
Total CD	63	37	30	25	22	654
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.3

DSNF Base Inventory - Regional Radworker CD Analysis Summary

Region : Time	100y	200y	300y	400y	500y	100 - 10Ky
1	64	38	30	26	22	658
2	63	37	30	25	22	654
Total CD	127	75	60	51	44	1,313
Total LCFs	0.1	0.0	0.0	0.0	0.0	0.5

Radworker

DSNF Module 1 Inventory - Region 1 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	10	6	5	4	4	108
Demolition	10	6	5	4	4	107
Unload & Reload	50	31	25	21	19	548
Repair	2	N/A	N/A	N/A	N/A	2
Surveillance	4	1	1	1	1	26
Total CD	76	45	36	31	27	792
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.3

DSNF Module 1 Inventory - Region 2 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	26	16	13	11	9	280
Demolition	26	16	13	11	9	278
Unload & Reload	130	81	65	55	48	1,415
Repair	6	N/A	N/A	N/A	N/A	6
Surveillance	10	4	3	2	2	67
Total CD	198	117	93	80	69	2,046
Total LCFs	0.1	0.0	0.0	0.0	0.0	0.8

DSNF Module 1 Inventory - Regional Radworker CD Analysis Summary						
Region : Time	100y	200y	300y	400y	500y	100 - 10Ky
1	76	45	36	31	27	792
2	198	117	93	80	69	2,046
Total CD	274	162	129	110	96	2,837
Total LCFs	0.1	0.1	0.1	0.0	0.0	1.1

Task	HLW DSC Caretaker FTE Loading				Recurrence	Recurrence
	Workers	Duration	Wrkr-Hrs	FTE	Frequency	FTE
Construction	No Data	No Data	1,069	0.53 per DSC	100	53.45
Demolition	No Data	No Data	130	0.065 per DSC	99	6.44
Unload & Reload	No Data	No Data	130	0.065 per DSC	100	6.50
Repair	No Data	No Data	222	0.111 per DSC	1	0.11
Surveillance	2	1	17,532	8.77 per Site	10,000	87,660

HLW Base Inventory - Region 1 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	4,009	328	145	0	15.5%	4.3%
Demolition	483	39	17	0	1.9%	0.5%
Unload & Reload	488	15	6	0	0.5%	0.5%
Repair	8	1	0	0	0.0%	0.0%
Surveillance	87,660	2,631	1,135	3	82.1%	94.6%
Total	92,647	3,014	1,304	3	100.0%	100.0%
Commuter Trips	2.32E+07	Commuter Fatalities		9		

HLW Base Inventory - Region 2 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	321,857	26,341	11,659	39	77.9%	55.9%
Demolition	38,752	3,171	1,404	5	9.4%	6.7%
Unload & Reload	39,143	1,175	507	1	2.3%	6.8%
Repair	668	55	24	0	0.2%	0.1%
Surveillance	175,320	5,262	2,270	5	10.3%	30.5%
Total	575,740	36,004	15,864	50	100.0%	100.0%
Commuter Trips	1.44E+08	Commuter Fatalities		53		

HLW Base Inventory - Region 5 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	106,520	8,718	3,858	13	74.0%	48.4%
Demolition	12,825	1,050	465	2	8.9%	5.8%
Unload & Reload	12,955	389	168	0	2.2%	5.9%
Repair	221	18	8	0	0.2%	0.1%
Surveillance	87,660	2,631	1,135	3	14.7%	39.8%
Total	220,180	12,805	5,634	17	100.0%	100.0%
Commuter Trips	5.50E+07	Commuter Fatalities		20		

HLW Base Inventory - Regional Worker Safety Analysis Summary

Region	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
1	92,647	3,014	1,304	3	4.6%	11.6%
2	575,740	36,004	15,864	50	74.2%	72.3%
5	220,180	12,805	5,634	17	25.8%	27.7%
Total	795,921	48,809	21,497	67	100.0%	100.0%
Commuter Trips	1.99E+08	Commuter Fatalities		74		

HLW Module 1 Inventory - Region 1 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	4,009	328	145	0	15.5%	4.3%
Demolition	483	39	17	0	1.9%	0.5%
Unload & Reload	488	15	6	0	0.5%	0.5%
Repair	8	1	0	0	0.0%	0.0%
Surveillance	87,660	2,631	1,135	3	82.1%	94.6%
Total	92,647	3,014	1,304	3	100.0%	100.0%
Commuter Trips	2.32E+07	Commuter Fatalities		9		

HLW Module 1 Inventory - Region 2 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	330,729	27,067	11,980	40	78.1%	56.4%
Demolition	39,820	3,259	1,442	5	9.4%	6.8%
Unload & Reload	40,222	1,207	521	1	2.3%	6.9%
Repair	687	56	25	0	0.2%	0.1%
Surveillance	175,320	5,262	2,270	5	10.0%	29.9%
Total	586,778	36,851	16,238	51	100.0%	100.0%
Commuter Trips	1.47E+08	Commuter Fatalities		54		

HLW Module 1 Inventory - Region 5 Worker Safety Analysis

Task	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
Construction	844,033	69,076	30,574	101	76.8%	53.6%
Demolition	101,622	8,317	3,681	12	9.2%	6.4%
Unload & Reload	102,648	3,081	1,329	3	2.3%	6.5%
Repair	1,753	143	63	0	0.2%	0.1%
Surveillance	525,960	15,785	6,810	15	11.6%	33.4%
Total	1,576,016	96,402	42,458	132	100.0%	100.0%
Commuter Trips	3.94E+08	Commuter Fatalities		146		

HLW Module 1 Inventory - Regional Worker Safety Analysis Summary

Region	FTE	TRC	LWC	ISF	ISF/ISF _T	FTE/FTE _T
1	92,647	3,014	1,304	3	1.7%	4.3%
2	586,778	36,851	16,238	51	27.8%	27.1%
5	1,576,016	96,402	42,458	132	72.2%	72.9%
Total	2,162,794	133,253	58,696	183	100.0%	100.0%
Commuter Trips	5.41E+08	Commuter Fatalities		200		

HLW Base Inventory - Region 1 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	0	0	0	0	0	0
Demolition	0	0	0	0	0	0
Unload & Reload	0.5	0	0	0	0	3.3
Repair	0.3	N/A	N/A	N/A	N/A	0.3
Surveillance	1	0.0	0.0	0	0	2
Total CD	2	0.2	0.1	0	0	5
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.0

HLW Base Inventory - Region 2 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	0	0	0	0	0	0
Demolition	0	0	0	0	0	0
Unload & Reload	41	11	5	3	2	263
Repair	22	N/A	N/A	N/A	N/A	22
Surveillance	93	3	1	1	1	151
Total CD	156	14	6	4	3	435
Total LCFs	0.1	0.0	0.0	0.0	0.0	0.2

HLW Base Inventory - Region 5 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	0	0	0	0	0	0
Demolition	0	0	0	0	0	0
Unload & Reload	14	4	2	1	1	87
Repair	7	N/A	N/A	N/A	N/A	7
Surveillance	31	1	0	0	0	50
Total CD	52	5	2	1	1	144
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.1

HLW Base Inventory - Regional Radworker CD Analysis Summary

Region : Time	100y	200y	300y	400y	500y	100 - 10Ky
1	2	0	0	0	0	5
2	156	14	6	4	3	435
5	52	5	2	1	1	144
Total CD	210	19	9	6	4	584
Total LCFs	0.1	0.0	0.0	0.0	0.0	0

HLW Module 1 Inventory - Region 1 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	0	0	0	0	0	0
Demolition	0	0	0	0	0	0
Unload & Reload	1	0	0	0	0	3
Repair	0	N/A	N/A	N/A	N/A	0
Surveillance	1	0	0	0	0	2
Total CD	2	0	0	0	0	5
Total LCFs	0.0	0.0	0.0	0.0	0.0	0.0

HLW Module 1 Inventory - Region 2 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	0	0	0	0	0	0
Demolition	0	0	0	0	0	0
Unload & Reload	42	11	5	3	3	270
Repair	22	N/A	N/A	N/A	N/A	22
Surveillance	96	3	1	1	1	155
Total CD	160	14	7	4	3	447
Total LCFs	0.1	0.0	0.0	0.0	0.0	0.2

HLW Module 1 Inventory - Region 5 Radworker CD Analysis

Task : Time	100y	200y	300y	400y	500y	100 - 10Ky
Construction	0	0	0	0	0	0
Demolition	0	0	0	0	0	0
Unload & Reload	108	29	13	9	6	689
Repair	57	N/A	N/A	N/A	N/A	57
Surveillance	245	7	3	2	2	395
Total CD	409	36	17	11	8	1,140
Total LCFs	0.2	0.0	0.0	0.0	0.0	0.5

HLW Module 1 Inventory - Regional Radworker CD Analysis Summary

Region : Time	100y	200y	300y	400y	500y	100 - 10Ky
1	2	0	0	0	0	5
2	160	14	7	4	3	447
5	409	36	17	11	8	1,140
Total CD	572	51	24	15	11	1,592
Total LCFs	0.2	0.0	0.0	0.0	0.0	1

CSNF Base Inventory - Demolition Rubble Analysis

Region	Rubble Volume, m3	Truck Loads	Traffic Fatalities	Emissions Fatalities
1	1.58E+07	3.02E+06	5.4	0.018
2	1.69E+07	3.23E+06	5.8	0.019
3	1.35E+07	2.59E+06	4.6	0.015
4	6.42E+06	1.23E+06	2.2	0.007
5	4.75E+06	9.10E+05	1.6	0.005
Total	5.73E+07	1.10E+07	19.6	0.06
	Haul Distance	8.84E+08 km		

DSNF Base Inventory - Demolition Rubble Analysis

Region	Rubble Volume, m3	Truck Loads	Traffic Fatalities	Emissions Fatalities
2	1.53E+06	2.93E+05	0.5	0.0017
5	1.52E+06	2.92E+05	0.5	0.0017
Total	3.05E+06	5.85E+05	1.0	0.0034
	Haul Distance	4.71E+07 km		

HLW Base Inventory - Demolition Rubble Analysis

Region	Rubble Volume, m3	Truck Loads	Traffic Fatalities	Emissions Fatalities	HLWRPRV
1	1.42E+05	2.71E+04	0.048	0.00016	1.69
2	1.14E+07	2.18E+06	3.9	0.0126	HLWRPload
5	3.76E+06	7.21E+05	1.29	0.0042	0.32
Total	1.53E+07	2.93E+06	5.2	0.0170	
	Haul Distance	2.35E+08 km			

All Base Inventories - Demolition Rubble Analysis Summary

Region	Rubble Volume, m3	Truck Loads	Traffic Fatalities	Emissions Fatalities
1	1.59E+07	3.05E+06	5.4	0.018
2	2.98E+07	5.70E+06	10.2	0.033
3	1.35E+07	2.59E+06	4.6	0.015
4	6.42E+06	1.23E+06	2.2	0.007
5	1.00E+07	1.92E+06	3.4	0.011
Total	7.57E+07	1.45E+07	25.9	0.08
	Haul Distance	1.17E+09 km		

CSNF Module 1 Inventory - Demolition Rubble Analysis

Region	Rubble Volume, m3	Truck Loads	Traffic Fatalities	Emissions Fatalities
1	2.52E+07	4.83E+06	8.6	0.028
2	2.83E+07	5.43E+06	9.7	0.031
3	2.11E+07	4.05E+06	7.2	0.023
4	1.26E+07	2.42E+06	4.3	0.014
5	8.41E+06	1.61E+06	2.9	0.009
Total	9.57E+07	1.83E+07	32.7	0.11
	Haul Distance	1.48E+09 km		

DSNF Module 1 Inventory - Demolition Rubble Analysis

Region	Rubble Volume, m3	Truck Loads	Traffic Fatalities	Emissions Fatalities
2	1.84E+06	3.53E+05	0.6	0.0020
5	4.76E+06	9.11E+05	1.6	0.005
Total	6.60E+06	1.26E+06	2.3	0.007
	Haul Distance	1.02E+08 km		

HLW Module 1 Inventory - Demolition Rubble Analysis

Region	Rubble Volume, m3	Truck Loads	Traffic Fatalities	Emissions Fatalities
1	1.42E+05	2.71E+04	0.048	0.000157
2	1.17E+07	2.24E+06	4.0	0.0130
5	2.98E+07	5.71E+06	10.2	0.033
Total	4.16E+07	7.98E+06	14.2	0.046
	Haul Distance	6.42E+08 km		

All Module 1 Inventories - Demolition Rubble Analysis Summary

Region	Rubble Volume, m3	Truck Loads	Traffic Fatalities	Emissions Fatalities
1	2.53E+07	4.85E+06	8.7	0.028
2	4.19E+07	8.02E+06	14.3	0.046
3	2.11E+07	4.05E+06	7.2	0.023
4	1.26E+07	2.42E+06	4.3	0.014
5	4.30E+07	8.24E+06	14.7	0.048
Total	1.44E+08	2.76E+07	49.2	0.16
	Haul Distance	2.22E+09 km		

Controlled Storage Impacts During 10,000 Years			
Total of Inventory Class	Base	Module 1	Difference
Fatalities			
Industrial incident fatalities	325	490	165
Radiation LCFs, public	1.8	3.0	1.2
Radiation LCFs, workers	10.6	18.2	7.6
Commuter accident fatalities	734	905	171
Trucking accident fatalities	25.9	49.2	23.3
Trucking LCFs (emissions)	0.08	0.16	0.08
Total Fatalities	1,097	1,465	368
Other Impacts			
FTE worker-years	7.9E+06	9.8E+06	1.8E+06
Worker population (all-site average)	158,706	195,642	36,936
Worker population (single-site average)	10.0	11.5	1.5
Total recordable injury/illness cases	292,066	411,021	118,955
Lost workday cases	126,959	179,401	52,442
Commuter round trips	2.0E+09	2.4E+09	4.6E+08
Demolition rubble volume, m ³	7.6E+07	1.4E+08	6.8E+07
Collective dose, person-rem (public)	3,557	5,939	2,382
Collective dose, person-rem (workers)	26,554	45,596	19,042

Impacts Summary